2006 Lincoln LS
Workshop Manual

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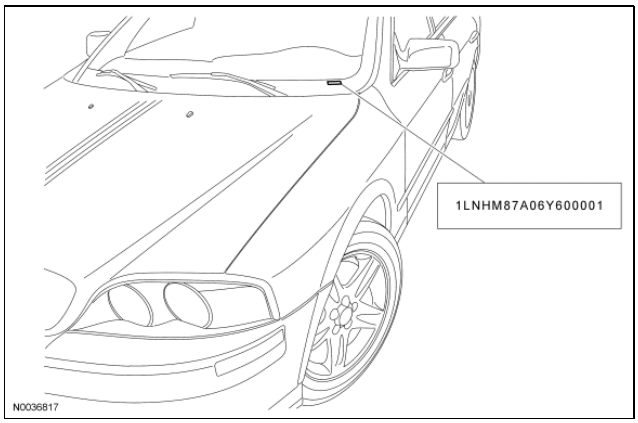
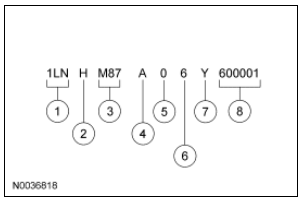
Identification Codes

Vehicle Identification Number

Vehicle Identification Number (VIN) Locator

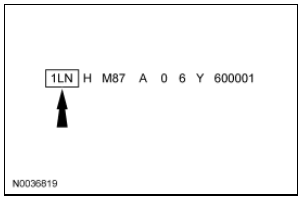


The vehicle identification number (VIN) is a 17-digit combination of letters and numbers. The VIN is stamped on a metal tab riveted on the instrument panel, top upper left of the dash. The VIN is also found on the vehicle certification (VC) label.



Item	Description
1	World manufacturer identifier
2	Vehicle restraint type
3	Vehicle line, series, body type
4	Engine type
5	Check digit
6	Model year
7	Assembly plant
8	Production sequence number

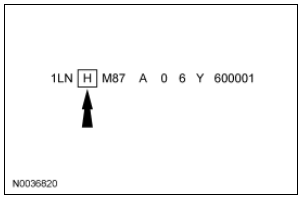
World Manufacturer Identifier



The first 3 vehicle identification number (VIN) positions are the world manufacturer identifier.

- 1LN — Ford Motor Company — Lincoln, USA, passenger car

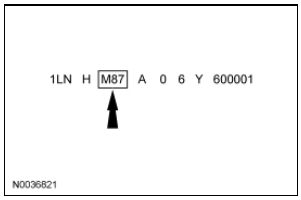
Vehicle Restraint Type



The fourth VIN position identifies the safety restraint system used.

- H — Active safety belts (all positions) — driver and front passenger air bags — driver and front passenger side impact air bags

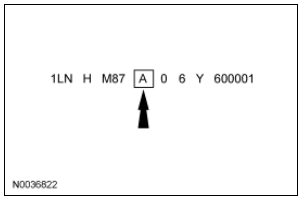
Line and Series



VIN positions 5 through 7 indicate the vehicle line and series.

- M87 — Lincoln LS — 8-cylinder, automatic

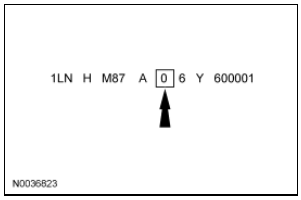
Engine Code



The eighth VIN position is the engine type (displacement and number of cylinders).

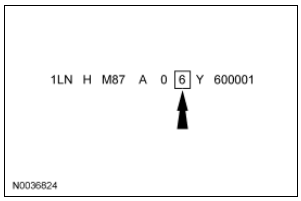
- A — 3.9L, DOHC, EFI, 8 cylinder

Check Digit



The ninth VIN position is a computer-generated check digit.

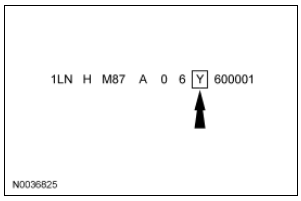
Model year



The tenth VIN position is the model year code.

- 6 — 2006

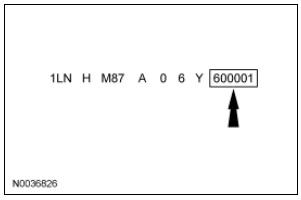
Assembly Plant



The eleventh VIN position is the assembly plant code.

- Y — Wixom (Wixom, Michigan)

Build Sequence

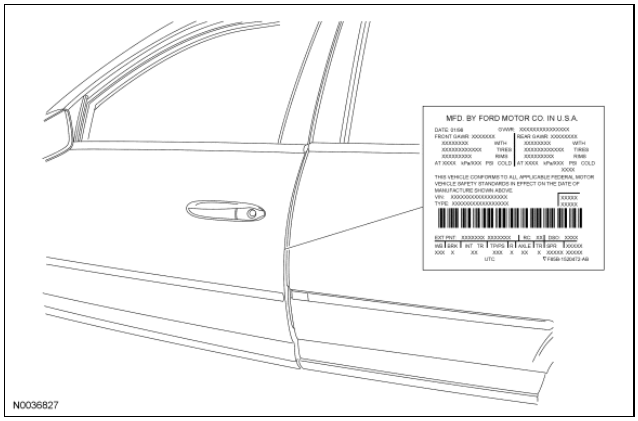


VIN positions 12 through 17 are an alphanumeric code for the vehicle build sequence. This is also the vehicle serial and warranty number.

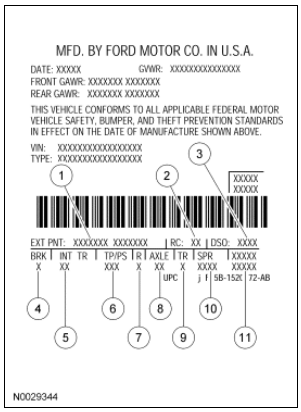
- Lincoln/Mercury — 600001 through 999999

Vehicle Certification (VC) Codes

Vehicle Certification (VC) Label Locator

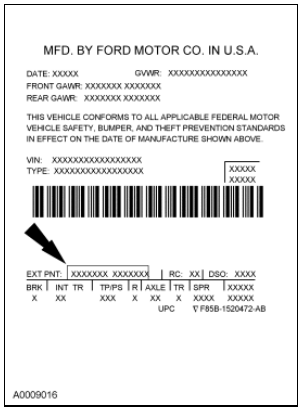


The VC label contains information on the manufacturer name, the month and year of manufacture, the certification statement and the VIN. This label also includes gross vehicle weight (GVW) information.



Item	Description
1	Exterior paint code
2	Region code
3	Domestic special order
4	Brake type code
5	Interior trim code
6	Tape/paint stripe code
7	Radio type code
8	Axle ratio code
9	Transmission code
10	Spring code
11	Powertrain calibration code

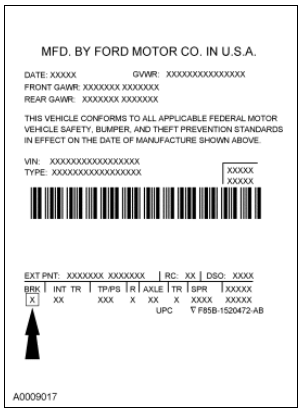
Exterior Paint



Exterior paint codes may be listed as a 2-part code. The first set of characters listed indicate the vehicle primary body color. The second set of characters listed (if applicable) indicate a 2-tone or accent body color. All codes are base coat/clear coat.

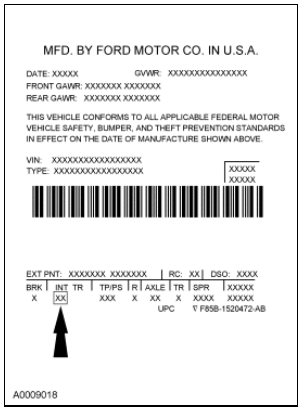
- DV — Light Tundra/Titanium Green
- F6 — Ceramic White (tri-coat)
- G2 — Redfire
- G3 — Pueblo Gold
- G4 — Cashmere (tri-coat)
- HH — Dark Cherry
- HJ — Pewter Metallic
- JP — Silver Birch Metallic
- T7 — Charcoal Beige
- UA — Ebony

Brake Type



- 3 — Anti-spin Traction Control brake system
- 6 — Interactive vehicle dynamics (IVD) brake system

Interior Trim



Interior trim codes are listed as a 2-part code. The first character identifies the interior trim type. The second character identifies the interior trim color.

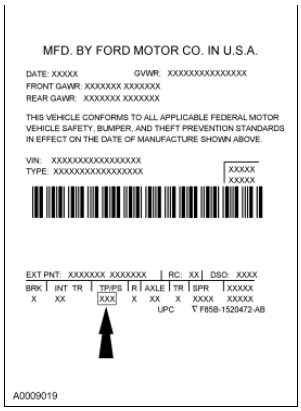
Interior Trim Type

- 4 — G-Grain leather
- 6 — Nudo leather

Interior Trim Color

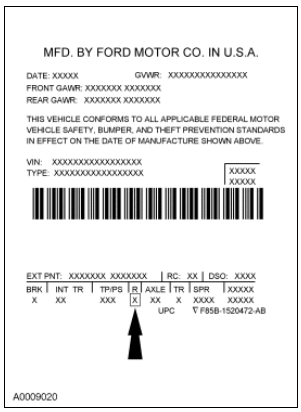
- C — Camel
- S — Dove II
- W — Black Ink

Tape/Paint Stripe



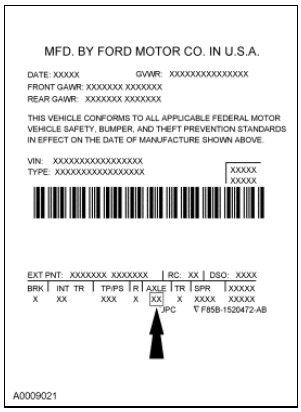
Tape and paint stripe codes do not apply.

Radio Code



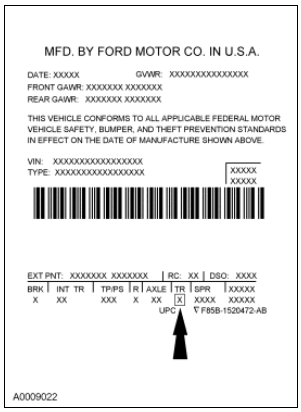
- 6 — AM/FM stereo with cassette, compact disc (CD) player and clock
- 9 — AM/FM stereo with CD player and navigation system
- X — AM/FM stereo with 6-disc CD changer (CDX6)

Axle Ratio Code



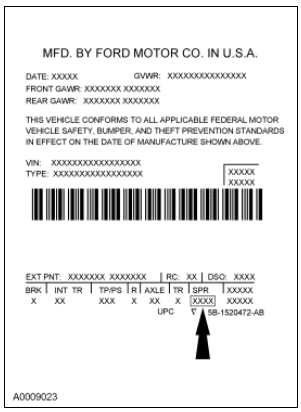
- 1 — 3.58 final drive ratio

Transmission Code



- A — 5-speed automatic overdrive, 5R55S (less manual select)
- S — 5-speed automatic overdrive, 5R55S (with manual select)

Spring Code



Spring codes are listed as a 2-part code. The first set of characters listed identify the front springs. The second set of characters listed identify the rear springs.

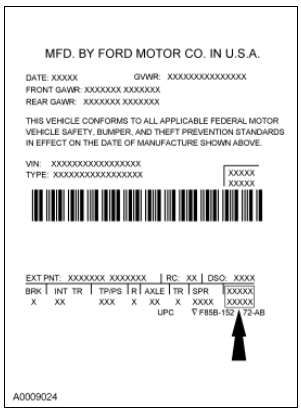
Front Springs

- Base part number — 18B036

Rear Springs

- Base part number — 18W002

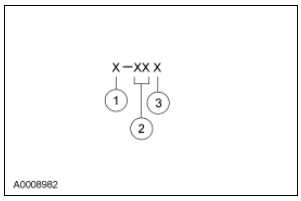
Powertrain Calibration Information



NOTE: Powertrain calibration information is limited to a maximum of 5 characters per line on the vehicle certification (VC) label. Because of this, calibration identification consisting of more that 5 characters will wrap to the second line on the VC label.

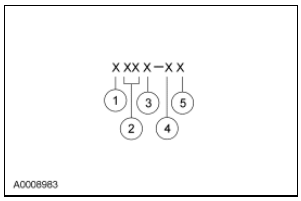
Powertrain calibration information is printed in the lower right corner of the VC label. Only base calibration information is printed. Revision levels will not appear, however, they can be found in On Line Automotive Service Information System (OASIS). For the current model year, Ford Motor Company is using 3 different protocols which describe powertrain base calibration. These protocols are designed to provide worldwide standardization for vehicle calibration. If the electronic calibration strategy was introduced in 1998 and carried into the current model year, Protocol 1 will be used. Refer to Protocol 1 below. If the electronic calibration strategy was introduced in 1999 and carried into the current model year, Protocol 2 will be used. Refer to Protocol 2 below. For electronic calibration strategy introduced in 2000 and beyond, Protocol 3 will be used. Refer to Protocol 3 below.

Protocol 1



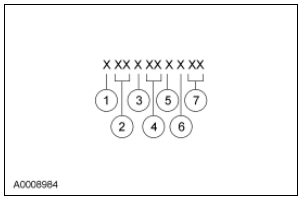
Item	Description
1	Model year (model year in which calibration strategy was first introduced)
2	Engine code
3	Engine revision level

Protocol 2



Item	Description
1	Model year (model year in which calibration strategy was first introduced)
2	Engine code
3	Transmission code
4	Emission standard (designates the specific country emission standard)
5	Design level (design level assigned to the engine)

Protocol 3



Item	Description
1	Model year (model year in which calibration strategy was first introduced)
2	Vehicle code
3	Transmission code
4	Unique calibration (designates different hardware to similar vehicles). Example: tires, drive ratios, etc.
5	Fleet code (describes fleet to which the vehicle belongs). Example: 6 - evaporative emissions
6	Certification region (lead region where multiple regions are included in one calibration). Example: A - U.S. federal
7	Revision level (will advance as revisions occur). Not printed on label

Protocol 3

The following offers a more detailed explanation of the coding strategy used in Protocol 3.

Model Year

- 2 — 2002
- 3 — 2003
- 4 — 2004
- 5 — 2005
- 6 — 2006

Vehicle Line

- LQ — Lincoln LS

Transmission
- 1 — Automatic transmission

Unique Calibration

The Emissions/CAFE/CO2 Compliance Department is responsible for assigning these calibration numbers. Unique calibration identifications are assigned to cover similar vehicles to differentiate tires, drive configurations, final drive ratios and other calibration-significant factors.

These 2 characters are chosen by the analyst to provide identifiable information unique to each calibration. For example, using the number 2 to denote a 2-valve engine versus using the number 4 to denote a 4-valve engine, offers an easily identifiable difference.

Fleet Code
- 0 — Certification (U.S. 4K, final sale in an export market)
- 1 — HDGE/Dyno
- 2 — Fast AMA, U.S.
- 3 — ADP, U.S.
- 4 — Not assigned
- 5 — Not assigned
- 6 — Evaporative emissions
- 7 — MACCA
- 8 — On-board diagnostics (OBD)
- 9 — Not assigned

Certification Region
- 5 — U.S. 50 states
- A — U.S. federal, including altitude, may include Canada and/or Mexico
- B — U.S. California, includes U.S. green states
- C — Canada
- D — China
- E — European Community
- F — Israel, South Korea
- G — Gulf Cooperative Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Jordan, Lebanon and UAE)
- J — Japan
- K — Korea
- L — Malaysia
- M — Mexico
- N — New Zealand
- P — Australia
- Q — South America (Brazil)
- U — South America (unleaded fuel regions)
- V — Vietnam
- X — Rest of world (ROW)
- Y — Military
- Z — Israel

Revision Level (not printed on label)
- 91-99 — Hardware calibration levels.
- 01-04 — Preliminary levels.
- 00 — Job 1 production (initial calibration).
- 05-09 — Pre-job 1 revisions to calibrations.

- 10-89 — Post-job 1 revisions to calibrations.
- 0B — Durability test level.
- BD — On-board diagnostics (OBD) intermediate level (pre-05).

Jacking

⚠ WARNING: Never run the engine with one wheel off the ground, such as when changing a tire. The wheel still on the ground could cause the vehicle to move.

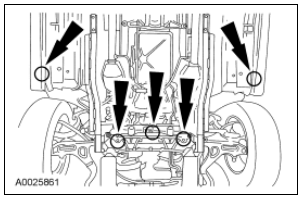
⚠ CAUTION: The jack (17080) provided with the vehicle is intended to be used in an emergency for changing a deflated tire. To avoid damage to the vehicle, never use the jack to lift the vehicle for any other purpose. Refer to the Owner Literature when using the jack supplied with the vehicle.

⚠ CAUTION: Under no circumstances should the vehicle ever be lifted by the front control arms, front I-braces, suspension arm brackets, rear stabilizer or differential housing. Severe damage to the vehicle could result.

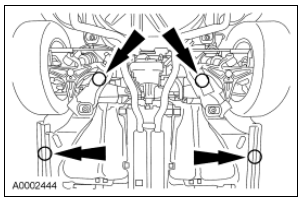
⚠ CAUTION: Do not attempt to use jack pressure on either the front bumper (17757) or the rear bumper (17906) of any vehicle. Damage to the bumper covers will occur.

Lift the vehicle using the following procedure.

Jacking Points



To lift the front or either side of the front end, position the floor jack or the hoist under the front frame lift points.



To lift the rear or either side of the rear end, position the floor jack or the hoist under the rear lift points.

Lifting

⚠ CAUTION: Do not allow the lift adapters to contact the steering linkage, suspension arms, front I-braces, stabilizer bar, or to compress the lower suspension arm stabilizer bar insulator (5493). Damage to the suspension, exhaust and steering linkage components may occur if care is not exercised when positioning the lift adapters prior to lifting the vehicle.

⚠ CAUTION: Never use the differential housing as a lift point. Damage to the differential housing and cover may occur.

⚠ CAUTION: Do not lift the vehicle on the rocker panel pinch flange except at the designated lift points or body damage may occur.

Lift the vehicle using the following procedure.

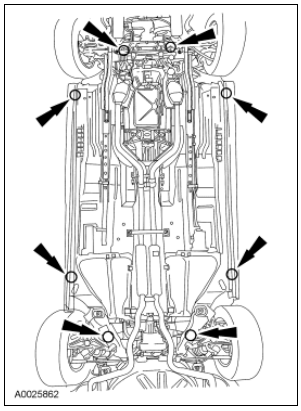
Lifting Points—Drive-On Hoist

⚠ CAUTION: To prevent possible damage to the underbody, do not drive the vehicle onto the drive-on hoist without first checking for possible interference.

Check for interference between the upright flanges of the hoist rails and the underbody.

If an interference exists, modify the hoist flanges or build up the approach ramps as necessary to provide clearance.

Lifting Points—Frame Contact Lift, Single-Post Lift, Two-Post Lift



⚠ CAUTION: Under no circumstances should the vehicle be lifted by the front control arms, front I-braces or rear control arms. Severe damage to the vehicle could result.

⚠ CAUTION: Do not position the lift pads under the No. 3 crossmember.

NOTE: Adapters maybe necessary to clear vehicle components to lift the vehicle safely. The adapters must be placed at the four designated contact points. Position the adapters so they are centered on the adapter contact area.

Lift the vehicle at the applicable lift points.

Maintenance Schedule — Gasoline Engines

The maintenance schedule is designed to protect against major repairs resulting from neglect or inadequate maintenance and to prolong the life of the vehicle.

General Maintenance Information

NOTE: This is a generic maintenance schedule for all Ford, Lincoln and Mercury vehicles. There may be items listed that do not apply to all vehicles.

The Normal Schedule applies to operation of the vehicle under typical, everyday driving conditions. The maintenance frequency in this schedule typifies what the vast majority of vehicles will require. The listed services should be carried out at specified mileage intervals. There are, however, additional services required that only the noted vehicles require.

If the vehicle is operated in one or more of the following special operating conditions, those additional services will be required. The special operating conditions are:

- towing or carrying heavy loads.
- extensive idling and/or driving at low speeds for long distances.
- driving in dusty conditions.
- off-road operation.
- use of E85 fuel 50% of the time or greater (flex fuel vehicles only).

There are also exceptions to the Normal Operating Schedule which will require more frequent maintenance for some components. Those exceptions are:

- standard vehicle axle — maintenance and lubrication.
- police and taxi vehicles — maintenance and lubrication.
- engine oil and Premium Gold coolant — time-based and mileage-based intervals.
- change brake fluid every 2 years (Class A Motorhome).

Special Operating Condition Requirements

When towing a trailer or using a camper or car-top carrier:

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles) or 3 months.
- Change automatic transmission fluid (not required on 6R60 transmission), lubricate 4x2 wheel bearings, install new grease seals and adjust bearings every 48,000 km (30,000 miles). If equipped, change the in-line service installed transmission fluid filter.
- Change transfer case fluid every 96,000 km (60,000 miles).
- Change manual transmission fluid as required.
- Inspect and lubricate U-joints and halfshafts as required.

During extensive idling and/or low speed driving for long distances, as in heavy commercial use such as delivery, taxi, patrol car or livery:

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles) or 3 months or 200 hours of engine operation.

- Lube front lower control arm and steering linkage ball joints with zerk fittings (if equipped) every 4,800 km (3,000 miles) or 3 months.
- Inspect brake system and check battery electrolyte level every 8,000 km (5,000 miles).
- Install a new fuel filter every 24,000 km (15,000 miles). (Not required for Fusion, Milan and Zephyr).
- Change automatic transmission fluid (not required on 6R60 transmission), lubricate 4x2 wheel bearings, install new grease seals and adjust bearings every 48,000 km (30,000 miles). If equipped, change the in-line service installed transmission fluid filter.
- Install new spark plugs and change transfer case fluid every 96,000 km (60,000 miles).
- Install a new cabin air filter as required (if equipped).

When operating in dusty conditions such as unpaved or dusty roads:

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles) or 3 months.
- Install a new fuel filter every 24,000 km (15,000 miles). (Not required for Fusion, Milan and Zephyr).
- Change automatic transmission fluid, check air filter restriction gauge and install a new filter as required (Focus engine only) every 48,000 km (30,000 miles). If equipped, change the in-line service installed transmission fluid filter.
- Change rear axle lubricant (E450 and F450/550 only).
- Change transfer case fluid every 96,000 km (60,000 miles).
- Install a new engine air filter as required.
- Install a new cabin air filter as required (if equipped).

When operating in off-road conditions:

- Change automatic transmission fluid every 48,000 km (30,000 miles). If equipped, change the in-line service-installed transmission fluid filter.
- Change rear axle lubricant every 80,000 km (50,000 miles) (E450 and F450/550 only).
- Change transfer case fluid every 96,000 km (60,000 miles).
- Install a new cabin air filter as required (if equipped).
- Inspect and lubricate U-joints and halfshafts.
- Inspect and lubricate steering linkage ball joints with zerk fittings.

Use of E85 fuel 50% of the time or greater (flex fuel vehicles only):

- Change engine oil and install a new oil filter every 4,800 km (3,000 miles), 3 months or 200 hours of engine operation (whichever occurs first).

Checks and Services

Certain basic maintenance checks and inspections should be carried out at specified intervals. Any recognized adverse condition should be corrected as soon as possible.

Multi-Point Inspection

The following inspections are recommended at every service interval:

- Check and top off brake, coolant, manual and automatic transmission (if equipped with a fluid level indicator), power steering and window washer fluids.
- Inspect tires for wear and correct air pressure, including spare tire.
- Check exhaust system for leaks, damage, loose parts and foreign material.
- Check battery performance.
- Check operation of horn, exterior lamps, turn signals and hazard warning lights.

- Check radiator, coolers, heater and air conditioning hoses.
- Inspect windshield wiper spray and wiper operation.
- Check windshield for cracks, chips and pitting.
- Inspect for oil and fluid leaks.
- Inspect air cleaner filter.
- Inspect halfshaft dust boots (if equipped).
- Check shocks, struts and other suspension components for leaks and damage.
- Inspect steering and linkage.
- Inspect accessory drive belt(s).
- Inspect clutch operation (if equipped).

In-Line, Service-Installed Transmission Fluid Filter

Some vehicles may be equipped with an in-line, service-installed transmission fluid filter. This filter is installed in the transmission fluid cooler return line. If equipped, install a new in-line filter during transmission fluid change intervals.

Maximum Oil Change Interval (Normal Schedule)

- 8,000 km (5,000 miles) or 6 months (whichever occurs first).

Maximum Oil Change Interval (Special Operating Conditions)

- 4,800 km (3,000 miles), 3 months or 200 hours of engine operation (whichever occurs first).

Monthly Checks

Check each of the following items every month:

- All interior and exterior lights for correct operation.
- Tires for wear and correct air pressure, including spare tire.
- Engine oil fluid level.
- Windshield washer solvent fluid level.

Six Month Checks

Check each of the following items at least every 6 months:

- Lap/shoulder belts and seat latches for wear and function.
- External mounted spare tire is stowed correctly (tight to body).
- Power steering fluid level.
- Washer spray, wiper operation and clean all wiper blades (install new wiper blades as necessary).
- Parking brake for correct operation.
- Lubricate all hinges, latches, door check straps and outside locks.
- Lubricate upper and lower sliding door tracks (if equipped).
- Clean sliding door contact switches (if equipped).
- Lubricate door rubber weatherstrips.
- Clean body and door drain holes.
- Safety warning lamps (brake, ABS, air bag, safety belt) for correct operation.
- Coolant system fluid level and correct strength.
- Battery connections. Clean if necessary.
- Clutch fluid level, if equipped.

Normal Schedule

NOTE: Rotate tires and inspect for wear at 5,000 miles, 15,000 miles and every 15,000 miles is required thereafter. At other 5,000-mile intervals, rotation is recommended for optimal life.

The following check procedures should be carried out for all cars, minivans, light trucks, sport utilities, vans, 4x4s and natural gas vehicles.

- Retighten the wheel nuts to the specified torque at 800 km (500 miles) after any wheel disturbance (tire rotation, changing a flat tire or wheel removal).
- On vehicles equipped with dual rear wheels, retighten the wheel nuts to the specified torque at 160 km (100 miles) and again at 800 km (500 miles) of new vehicle operation or after any wheel disturbance (tire rotation, changing a flat tire or wheel removal).

8,000 Km (5,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Multi-point inspection recommended.

16,000 Km (10,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

24,000 Km (15,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with a fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect steering linkage, ball joints, suspension and if equipped, half shafts, driveshaft and U-joints.
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate halfshafts, driveshaft and U-joints.
- Rotate tires and inspect for wear.
- Install a new cabin air filter (if equipped).
- Inspect and lubricate 4x4 front axle shaft U-joints (F250/350/450/550).
- Multi-point inspection recommended.

32,000 Km (20,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

40,000 Km (25,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

48,000 Km (30,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints and, if equipped, halfshafts, driveshaft and U-joints.
- Install a new engine air filter (not required for Focus).
- Install a new fuel filter (not required for Fusion, Milan and Zephyr).
- Install a new cabin air filter (if equipped).
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift, 4R100, 4F50N or 4F27E transmissions. Inspect automatic transmission fluid level using the fluid level indicator on all other vehicles (if equipped with a fluid level indicator). Change the in-line service-installed transmission fluid filter (if equipped).
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Lincoln LS, Zephyr, Freestar, Monterey, Expedition and Aviator).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Multi-point inspection recommended.

56,000 Km (35,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

64,000 Km (40,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

72,000 Km (45,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with a fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new cabin air filter (if equipped).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Multi-point inspection recommended.

80,000 Km (50,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Change rear axle fluid (Class A Motorhome).
- Multi-point inspection recommended.

88,000 Km (55,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

96,000 Km (60,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new engine air filter (not required for Focus).
- Install a new fuel filter (not required for Fusion, Milan and Zephyr).
- Install a new cabin air filter (if equipped).
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift, 4R100, 4F50N or 4F27E transmissions. Inspect automatic transmission fluid level on all other vehicles (if equipped with a fluid level indicator). Change the in-line service-installed transmission fluid filter (if equipped).
- Change automatic transmission fluid on all vehicles equipped with a CVT transmission and install a new high-pressure case filter and O-rings.
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Lincoln LS, Zephyr, Freestar, Monterey, Expedition and Aviator).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate 4x2 wheel bearings, replace grease seals and adjust bearings (if equipped with serviceable bearings).
- Change manual transmission fluid (if equipped) (except Escape).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Multi-point inspection recommended.

104,000 Km (65,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

112,000 Km (70,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

120,000 Km (75,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with a fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new cabin air filter (if equipped).
- Check air filter restriction gauge, install a new filter as necessary (Focus only).
- Lubricate steering linkage, suspension and ball joints (if equipped zerk fittings).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Multi-point inspection recommended.

128,000 Km (80,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

136,000 Km (85,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

144,000 Km (90,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new engine air filter (not required for Focus).
- Install a new fuel filter (not required for Fusion, Milan and Zephyr).
- Install a new cabin air filter (if equipped).
- Change automatic transmission/transaxle fluid on all vehicles equipped with TorqShift, 4R100, 4F50N or 4F27E transmissions. Replace the remote filter element on vehicles equipped with the Torqshift transmission. Inspect automatic transmission fluid level on all other vehicles (if equipped with a fluid level indicator). If equipped, change the in-line service-installed transmission fluid filter.
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Lincoln LS, Zephyr, Freestar, Monterey, Expedition and Aviator).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Multi-point inspection recommended.

152,000 Km (95,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.

- Multi-point inspection recommended.

160,000 Km (100,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect accessory drive belt(s).
- Install new spark plugs.
- Change rear axle fluid (F450/550, E-450 and Class A Motorhome).
- Change Premium Gold coolant or change at 5 years, whichever comes first.
- Install a new external PCV on all cars and light trucks under 6,000 pounds Gross Vehicle Weight (GVW) (except 3V engines).
- Multi-point inspection recommended.

168,000 Km (105,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with a fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine coolant system and hoses.
- Inspect steering linkage, suspension and ball joints.
- Inspect half shafts, driveshaft and U-joints (if equipped).
- Install a new cabin air filter (if equipped).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Multi-point inspection recommended.

176,000 Km (110,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

184,000 Km (115,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

192,000 Km (120,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new engine air filter (not required for Focus).
- Install a new fuel filter (not required for Fusion, Milan and Zephyr).

- Install a new cabin air filter (if equipped).
- Install a new external PCV valve on all cars and light trucks over 6,000 lbs. Gross Vehicle Weight (except 3V engines).
- Change automatic transmission/transaxle fluid on all vehicles equipped with TorqShift, 4R100, 4F50N or 4F27E transmissions. Install a new remote filter element on the vehicles equipped with the Torqshift transmission. Inspect automatic transmission fluid level on all other vehicles (if equipped with fluid level indicator). If equipped, change the in-line service-installed transmission fluid filter.
- Change automatic transmission fluid on all vehicles equipped with a CVT transmission and install a new high-pressure case filter and O-rings.
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Lincoln LS, Zephyr, Freestar, Monterey, Expedition and Aviator).
- Change manual transmission fluid (if equipped) (except Escape).
- Lubricate 4x2 wheel bearings, replace grease seals and adjust bearings (if equipped with serviceable bearings).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Multi-point inspection recommended.

200,000 Km (125,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

208,000 Km (130,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

216,000 Km (135,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect automatic transmission fluid level (if equipped with a fluid level indicator).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system (adjust parking brake if required).
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new cabin air filter (if equipped).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Multi-point inspection recommended.

224,000 Km (140,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

232,000 Km (145,000 Miles)

- Change engine oil and install a new oil filter.
- Inspect tires for wear. Rotation recommended for optimal tire life.
- Multi-point inspection recommended.

240,000 Km (150,000 Miles)

- Change engine oil and install a new oil filter.
- Rotate tires and inspect for wear.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect wheel ends for end play and noise.
- Inspect engine cooling system and hoses.
- Change Premium Gold coolant (see Exceptions To Normal Schedule and Mileage Base).
- Inspect exhaust system and heat shields.
- Inspect steering linkage, suspension and ball joints.
- Inspect halfshafts, driveshaft and U-joints (if equipped).
- Install a new fuel filter (not required for Fusion, Milan and Zephyr).
- Install a new engine air filter (not required on Focus).
- Check air filter restriction gauge, install a new air filter as necessary (Focus only).
- Install a new cabin air filter (if equipped).
- Change automatic transmission/transaxle fluid (except CVT transmission).
- Change automatic transaxle filter (except CVT, Five Hundred and Montego equipped with a 6-speed automatic transaxle).
- Change rear axle lubricant on all rear wheel (RWD) vehicles.
- Change rear axle fluid (Class A Motorhome).
- Install a new accessory drive belt(s) (if a new belt has not been installed within the last 100,000 miles).
- Install new climate controlled seat cushion filters (if equipped) (Navigator, Lincoln LS, Zephyr, Freestar, Monterey, Expedition and Aviator).
- Install a new climate controlled seat back filter (Zephyr only).
- Inspect PVC for flow (3V engines).
- Lubricate steering linkage, suspension and ball joints (if equipped with zerk fittings).
- Install new non-sealed 4x2 front wheel bearings and seals (if new bearings and seals have not been installed in the last 100,000 miles).
- Lubricate the 4x4 front axle shaft U-joints (if equipped) (F250/350/450/550).
- Change front axle lubricant (4x4 only).
- Change transfer case fluid (4x4 only).
- Multi-point inspection recommended.

Exceptions To Normal Schedule

Maximum Oil Change Interval

- Normal schedule: 8,000 km (5,000 miles) or 6 months, whichever occurs first.
- Special operating conditions: 4,800 km (3,000 miles), 3 months or 200 hours of operation, whichever occurs first.

Premium Gold Coolant

- Change Premium Gold coolant at 5 years or 160,000 km (100,000 miles) of the vehicle's life, whichever occurs first.
- After the initial change, change coolant every 3 years or 80,000 km (50,000 miles) thereafter.

Normal Vehicle Axle Maintenance

Rear axles and power take-off (PTO) units containing synthetic lubricant and light duty trucks equipped with Ford-design axles are lubricated for life. These lubricants are not to be checked or changed unless service is required, or if a leak is suspected or the axle assembly has been submerged in water.

The axle and PTO fluid should be changed anytime they have been submerged in water. Non-synthetic rear axle lubricants should be replaced every 4,800 km (3,000 miles) or 3 months, whichever occurs first, during extended trailer tow operation above 21°C (70°F) ambient and wide open throttle for extended periods above 45 mph.

The 3,000 mile lube change interval may be waived if the axle was filled with 75W140 synthetic gear lubricant meeting Ford specification WSL-M2C192-A, part number F1TZ-19580-B or equivalent. Add 4 ounces of additive friction modifier C8AZ-19B546-A (EST-M2C118-A) or equivalent for complete refill of Traction-Lok® rear axles.

The axle lubricant should be changed anytime an axle has been submerged in water.

Police and Taxi Vehicle Axle Maintenance

Replace rear axle lubricant every 160,000 km (100,000 miles). Rear axle lubricant change may be waived if the axle was filled with 75W140 synthetic gear lubricant meeting Ford specification WSL-M2C192-A, part number FITZ-19580-B or equivalent. Add 4 ounces of additive friction modifier C8AZ-19B546-A (EST-M2C118-A) or equivalent for complete refill of Traction-Lok® rear axles.

The axle lubricant should be changed anytime an axle has been submerged in water.

E and F 450 and 550 Series Axle Maintenance

Replace rear axle lubricant every 100,000 miles under normal driving conditions on all E and F 450 and 550 series applications. For E and F 450 and 550 series vehicles operated at or near maximum Gross Vehicle Weights, the rear axle lubricant should be replaced every 50,000 miles.

In addition, the 50,000 mile schedule should be observed when the vehicles are operated under the Special Operating Conditions.

Class A Motorhome

- Every 2 years — change brake fluid.
- Every 48,000 km (30,000 miles) — change the automatic transmission fluid.
- Change rear axle fluid at 80,000 km (50,000 miles), 160,000 km (100,000 miles) and 240,000 km (150,000 miles).

Noise, Vibration and Harshness (NVH)

Noise is any undesirable sound, usually unpleasant in nature. Vibration is any motion, shaking or trembling, that can be felt or seen when an object moves back and forth or up and down. Harshness is a ride quality issue where the vehicle's response to the road transmits sharply to the customer. Harshness normally describes a firmer than usual response from the suspension system. Noise, vibration and harshness (NVH) is a term used to describe these conditions, which result in varying degrees of dissatisfaction. Although, a certain level of NVH caused by road and environmental conditions is normal. This section is designed to aid in the diagnosis, testing and repair of NVH concerns.

Acceptable Noise, Vibration and Harshness

All internal combustion engines and drivelines produce some noise and vibration; operating in a real world environment adds noise that is not subject to control. Vibration isolators, mufflers and dampers reduce these to acceptable levels. A driver who is unfamiliar with a vehicle can think that some sounds are abnormal when actually the sounds are normal for the vehicle type. For example, Traction-Lok® differentials produce a slight noise on slow turns after extended highway driving. This is acceptable and has no detrimental effect on the locking axle function. As a technician, it is very important to be familiar with vehicle features and know how they relate to NVH concerns and their diagnosis. For example, if the vehicle has automatic overdrive, it is important to test drive the vehicle both in and out of overdrive mode.

Diagnostic Theory

The shortest route to an accurate diagnosis results from:

- system knowledge, including comparison with a known good system.
- system history, including repair history and usage patterns.
- condition history, especially any relationship to repairs or sudden change.
- knowledge of possible sources.
- using a systematic diagnostic method that divides the system into related areas.

The diagnosis and correction of noise, vibration and harshness concerns requires:

- a road or system test to determine the exact nature of the concern.
- an analysis of the possible causes.
- testing to verify the cause.
- repairing any concerns found.
- a road test or system test to make sure the concern has been corrected or brought back to within an acceptable range.

Glossary of Terms

Acceleration — Light

An increase in speed at less than 1/2 throttle.

Acceleration — Medium

An increase in speed at 1/2 to nearly full throttle, such as 0-97 km/h (0-60 mph) in approximately 30 seconds.

Acceleration — Heavy

An increase in speed at 1/2 to full throttle, such as 0-97 km/h (0-60 mph) in approximately 20 seconds.

Ambient Temperature

The surrounding or prevailing temperature.

Amplitude

The quantity or amount of energy produced by a vibrating component (G force). An extreme vibration has a high amplitude. A mild vibration has a low amplitude.

Backlash

Gear teeth clearance.

Boom

Low frequency or low pitched noise often accompanied by a vibration. Also refer to drumming.

Bound Up

An overstressed isolation (rubber) mount that transmits vibration/noise instead of absorbing it.

Brakes Applied

When the service brakes are applied with enough force to hold the vehicle against movement with the transmission in gear.

Buffet/Buffeting

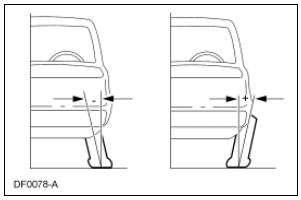
Strong noise fluctuations (less than 1000 Hz) caused by gusting winds. An example would be wind gusts against the side glass.

Buzz

A low-pitched sound (200-5000 Hz) like that from a bee. Often a metallic or hard plastic humming sound. Also describes a high frequency (200-800 Hz) vibration. Vibration feels similar to an electric razor.

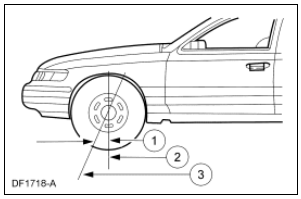
Camber

The angle of the wheel in relation to the true vertical as measured looking from the front of the vehicle. Camber is positive when the wheel angle is offset so that the top of the wheel is positioned away from the vehicle.



Caster

The angle of the steering knuckle in relation to the true vertical as measured looking from the side of the vehicle.



Item	Description
1	Positive caster
2	True vertical
3	Steering axis

Chatter

A pronounced series of rapidly repeating rattling or clicking sounds.

Chirp

A short-duration high-pitched noise associated with a slipping drive belt.

Chuckle

A repetitious low-pitched sound. A loud chuckle is usually described as a knock.

Click

A sharp, brief, non-resonant sound, similar to actuating a ball point pen.

Clonk

A hydraulic knocking sound. Sound occurs with air pockets in a hydraulic system. Also described as hammering.

Clunk/Driveline Clunk

A heavy or dull, short-duration, low-frequency sound. Occurs mostly on a vehicle that is accelerating or decelerating abruptly. Also described as a thunk.

Coast/Deceleration

Releasing the accelerator pedal at cruise, allowing the engine to reduce vehicle speed without applying the brakes.

Coast/Neutral Coast

Placing the transmission range selector in NEUTRAL (N) or depressing the clutch pedal while at cruise.

Constant Velocity (CV) Joint

A joint used to absorb vibrations caused by driving power being transmitted at an angle.

Controlled Rear Suspension Height

The height at which a designated vehicle element must be when driveline angle measurements are made.

Coupling Shaft

The shaft between the transfer case and the front drive axle or, in a 2-piece rear driveshaft, the front section.

CPS

Cycles per second. Same as hertz (Hz).

Cracks

A mid-frequency sound, related to squeak. Sound varies with temperature conditions.

Creak

A metallic squeak.

Cruise

Constant speed on level ground; neither accelerating nor decelerating.

Cycle

The process of a vibrating component going through a complete range of motion and returning to the starting point.

Decibel

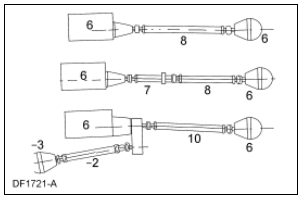
A unit of measurement, referring to sound pressure level, abbreviated dB.

Drive Engine Run-Up (DERU) Test

The operation of the engine through the normal rpm range with the vehicle standing still, the brakes applied and the transmission engaged. This test is used for noise and vibration checks.

Driveline Angles

The differences of alignment between the transmission output shaft, the driveshaft and the rear axle pinion centerline.



Driveshaft

The shaft that transmits power to the rear axle input shaft (pinion shaft). In a 2-piece driveshaft, it is the rearmost shaft.

Drivetrain

All power transmitting components from the engine to the wheels; includes the clutch or torque converter, the transmission, the transfer case, the driveshaft and the front or rear drive axle.

Drivetrain Damper

A weight attached to the engine, the transmission, the transfer case or the axle. It is tuned by weight and placement to absorb vibration.

Drone

A low frequency (100-200 Hz) steady sound, like a freezer compressor. Also described as a moan.

Drumming

A cycling, low-frequency (20-100 Hz), rhythmic noise often accompanied by a sensation of pressure on the ear drums. Also described as a low rumble, boom or rolling thunder.

Dynamic Balance

The equal distribution of weight on each side of the centerline, so that when the wheel and tire assembly spins, there is no tendency for the assembly to move from side-to-side (wobble). Dynamically unbalanced wheel and tire assemblies can cause wheel shimmy.

Engine Imbalance

A condition in which an engine's center mass is not concentric to the rotation center, causing excessive motion.

Engine Misfire

When combustion in one or more cylinders does not occur or occurs at the wrong time.

Engine Shake

An exaggerated engine movement or vibration that directly increases in frequency as the engine speed increases. It is caused by non-equal distribution of mass in the rotating or reciprocating components.

Flexible Coupling

A flexible joint.

Float

A drive mode on the dividing line between cruise and coast where the throttle setting matches the engine speed with the road speed.

Flutter

Mid to high (100-2000 Hz) intermittent sound due to air flow. Similar to a flag flapping in the wind.

Frequency

The rate at which a cycle occurs within a given time.

Gravelly Feel

A grinding or growl in a component, similar to the feel experienced when driving on gravel.

Grind

An abrasive sound, similar to using a grinding wheel, or rubbing sand paper against wood.

Hiss

Steady high frequency (200-800 Hz) noise. Vacuum leak sound.

Hoot

A steady low frequency tone (50-500 Hz), sounds like blowing over a long neck bottle.

Howl

A mid-range frequency (200-800 Hz) noise between drumming and whine. Also described as a hum.

Hum

Mid-frequency (200-800 Hz) steady sound, like a small fan motor. Also described as a howl.

Hz

Hertz; a frequency measured in cycles per second.

Imbalance

Out of balance; heavier on one side than the other. In a rotating component, imbalance often causes vibration.

Inboard

Toward the centerline of the vehicle.

Intensity

The physical quality of sound that relates to the strength of the vibration (measured in decibels). The higher the sound's amplitude, the higher the intensity and vice versa.

Isolate

To separate the influence of one component to another.

Knock

A heavy, loud, repetitious sound, like a knock on the door.

Moan

A constant, low-frequency (100-200 Hz) tone. Also described as a hum.

Neutral Engine Run-Up (NERU) Test

The operation of the engine through the normal rpm range with the vehicle standing still and the transmission disengaged. This test is used to identify engine related vibrations.

Neutralize/Normalize

To return to an unstressed position. Used to describe mounts. Also refer to bound up.

Outboard

Away from the centerline of the vehicle.

Ping

A short duration, high-frequency sound, which has a slight echo.

Pinion Shaft

The input shaft in a driving axle that is usually a part of the smaller driving or input hypoid gear of a ring and pinion gearset.

Pitch

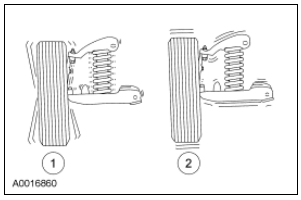
The physical quality of sound that relates to its frequency. Pitch increases as frequency increases and vice versa.

Pumping Feel

A slow, pulsing movement.

Radial/Lateral

Radial is in the plane of rotation; lateral is at 90 degrees to the plane of rotation.



Item	Description
1	Lateral runout
2	Radial runout

Rattle

A random and momentary or short duration noise.

Ring Gear

The large, circular, driven gear in a ring and pinion gearset.

Road Test

The operation of the vehicle under conditions intended to produce the concern under investigation.

Roughness

A medium-frequency vibration. A slightly higher frequency (20 to 50 Hz) than a shake. This type of vibration is usually related to drivetrain components.

Runout

Lateral runout means measuring the movement or "wobble" of a wheel or tire at the sidewall. Radial runout means measuring the out-of-round at the tread surface.

Rustling

Intermittent sound of varying frequency (100-2000 Hz), sounds similar to shuffling through leaves.

Shake

A low-frequency vibration (5-20 Hz), usually with visible component movement. Usually relates to tires, wheels, brake drums or brake discs if it is vehicle speed sensitive, or engine if it is engine speed sensitive. Also referred to as a shimmy or wobble.

Shimmy

An abnormal vibration or wobbling, felt as a side-to-side motion of the steering wheel in the driveshaft rotation. Also described as waddle.

Shudder

A low-frequency vibration that is felt through the steering wheel or seat during light brake application.

Slap

A resonance from flat surfaces, such as safety belt webbing or door trim panels.

Slip Yoke/Slip Spline

The driveshaft coupling that allows length changes to occur while the suspension articulates and while the driveshaft rotates.

Squeak

A high-pitched transient sound, similar to rubbing fingers against a clean window.

Squeal

A long-duration, high-pitched noise.

Static Balance

The equal distribution of weight around the wheel. Statically unbalanced wheel and tire assemblies can cause a bouncing action called wheel tramp. This condition will eventually cause uneven tire wear.

Tap

A light, rhythmic, or intermittent hammering sound, similar to tapping a pencil on a table edge.

Thump

A dull beat caused by 2 items striking together.

Tick

A rhythmic tap, similar to a clock noise.

Tip-In Moan

A light moaning noise heard during light vehicle acceleration, usually between 40-100 km/h (25-65 mph).

TIR

The acronym for total indicated runout is TIR.

Tire Deflection

The change in tire diameter in the area where the tire contacts the ground.

Tire Flat Spots

A condition commonly caused by letting the vehicle stand while the tires cool off. This condition can be corrected by driving the vehicle until the tires are warm. Also, irregular tire wear patterns in the tire tread resulting from wheel-locked skids.

Tire Force Vibration

A tire vibration caused by variations in the construction of the tire that is noticeable when the tire rotates against the pavement. This condition can be present on perfectly round tires because of variations in the inner tire construction. This condition can occur at wheel rotation frequency or twice rotation frequency.

Transient

A noise or vibration that is momentary, a short duration.

Two-Plane Balance

Radial and lateral balance.

Vibration

Any motion, shaking or trembling, that can be felt or seen when an object moves back and forth or up and down.

Whine

A constant, high-pitched noise. Also described as a screech.

Whistle

High-pitched noise (above 500 Hz) with a very narrow frequency band. Examples of whistle noises are a turbocharger or airflow around an antenna.

Wind Noise

Any noise caused by air movement in, out or around the vehicle.

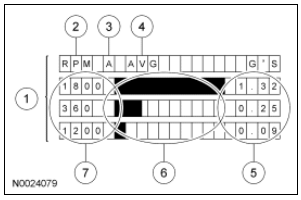
WOT

The acronym for wide open throttle is WOT.

Tools and Techniques

Vibration Analyzer (EVA)

The vibration analyzer (EVA) is a hand-held electronic scan tool which will assist in locating the source of unacceptable vibrations. The vibration sensor can be remotely mounted anywhere in the vehicle for testing purposes. The unit displays the 3 most common vibration frequencies and their corresponding amplitudes simultaneously. A bar graph provides a visual reference of the relative signal strength (amplitude) of each vibration being displayed and its relative G force. The keypad is arranged to make the EVA simple to program and use. Some of the functions include the ability to average readings as well as record, play back and freeze readings. The EVA has a strobe balancing function that can be used to detect imbalance on rotating components such as a driveshaft or engine accessories.



Item	Description
1	EVA screen
2	Frequency mode displayed in rpm or Hz
3	Active sensor input (A or B)
4	Current active mode
5	G force indicators or the strongest frequencies in descending strength of each vibration
6	Strength of each vibration
7	Frequency in rpm/Hz of each vibration

The EVA allows for a systematic collection of information that is necessary to accurately diagnose and repair NVH problems. For the best results, carry out the test as follows:

a. Test drive the vehicle with the vibration sensor inside the vehicle.
b. Place the sensor in the vehicle according to feel.

- If the condition is felt through the steering wheel, the source is most likely in the front of the vehicle.
- A vibration that is felt in the seat or floor only will most likely be found in the driveline, drive axle or rear wheels and tires.

c. Record the readings. Also note when the condition begins, when it reaches maximum intensity and if it tends to diminish above/below a certain speed.
   - Frequencies should be read in the "average" mode.
   - Frequencies have a range of plus or minus 2. A reading of 10 Hz can be displayed as an 8 Hz through 12 Hz.
   - Frequencies with a reading of 0.06 Gs or less, are barely perceptible NVH levels. No corrective action is necessary.

d. Place the vibration sensor on or near the suspect area outside the vehicle.
e. Continue the road test, driving the vehicle at the speed the symptom occurs, and take another reading.
f. Compare the readings.
   - A match in frequency indicates the problem component or area.
   - Example: A vibration is felt in the seat. Place the sensor on the console. Record the readings. Place the vibration sensor on the rear axle. Compare the readings. If the frequencies are the same, the axle is the problem component.
   - If the 2 readings are not the same frequency, then diagnose the frequency with the most significant amplitude (Gs) first.

NVH Analyzer (Vetronix)

The MTS 4000 and the MTS 4100 NVH analyzers are tools to aid in the identification and isolation of a noise, vibration or harshness concern in a vehicle. They measures noise and vibration data and compare it with data obtained from the vehicle's powertrain control module (PCM) in order to provide possible sources. The MTS 4000 and the 4100 have the following characteristics:

- Interfaces with the vehicle's computer system
- Support and store vibration data input from 1 or 2 accelerometers
- Support and store noise data input from 2 microphones
- Provide a photo-tachometer for operation of the driveshaft balancing function
- Provide a strobe output capable of driving a standard timing light
- Contain a real time clock circuit that provides time and date information which is used for tagging test data
- Have the capability to print to an external printer and interface with a PC
- Can be powered from a variety of power sources: cigarette lighter, AC power or the internal battery pack

The MTS 4000 and the 4100 NVH analyzers have 4 main operating modes. The first is for vibration diagnosis. This mode measures data from 1 or 2 accelerometers simultaneously while obtaining data from the vehicle's computer system about the operation of the vehicle. Then it does a frequency analysis on the accelerometer information and compares the vibration frequencies with the frequencies associated with various rotating components within the vehicle. The data can be presented in 4 different display modes: principle component, bar chart, frequency spectrum or waterfall. All display mode formats contain the same common elements, such as amplitude.

The second is for noise diagnosis. This mode measures noise from 1 or 2 microphones simultaneously. All noise measurements are in db's. All frequency bands used for noise measurements are the same as for the vibration measurements, up to 1000 Hz.

The third is driveshaft balancing. Driveshaft balancing is done using 1 or 2 accelerometers and a photo-tachometer. The accelerometers measure the vibrations at both ends of the driveshaft, while the photo-tachometer measures the rotation speed and position reference.

The fourth mode is the strobe. A strobe or standard timing light can be connected to an analyzer, to provide a means for measuring rotational speed. The strobe function is used for isolating the source of a vibration.

Vibrate Software®

Vibrate Software® (Rotunda tool number 215-00003) is a diagnostic aid which will assist in pinpointing the source of unacceptable vibrations. The engine's crankshaft is the point of reference for vibration diagnosis. Every rotating component will have an angular velocity that is faster, slower or the same as the engine's crankshaft. Vibrate Software® calculates the angular velocity of each component and graphically represents these velocities on a computer screen and on a printed vibration worksheet. The following steps outline how Vibrate Software® helps diagnose a vibration concern:

- Enter the vehicle information. Vibrate will do all the calculations and display a graph showing tire, driveshaft and engine vibrations.
- Print a Vibration Worksheet graph. The printed graph is to be used during the road test.
- Road test the vehicle at the speed where the vibration is most noticeable. Record the vibration frequency (rpm) and the engine rpm on the worksheet graph. The point on the graph where the vibration frequency (rpm) reading and the engine rpm reading intersect indicates the specific component group causing the concern.
    - ♦ A EVA or equivalent tool capable of measuring vibration frequency and engine rpm will be needed.
- Provide pictures of diagnostic procedures to aid in testing components.

Combination EngineEAR/ChassisEAR

An electronic listening device used to quickly identify noise and the location under the chassis while the vehicle is being road tested. The ChassisEARs can identify the noise and location of damaged/worn wheel bearings, CV joints, brakes, springs, axle bearings or driveshaft carrier bearings.

EngineEAR Basic Unit

An electronic listening device used to detect even the faintest noises, the EngineEARs can detect the noise of damaged/worn bearings in generators, coolant pumps, A/C compressors and power steering pumps. They are also used to identify noisy lifters, exhaust manifold leaks, chipped gear teeth and for detecting wind noise. The EngineEAR has a sensing tip, amplifier and headphones. The directional sensing tip is used to listen to the various components. Point the sensing tip at the suspect component and adjust the volume with the amplifier. Placing the tip in direct contact with a component will reveal structure-borne noise and vibrations, generated by or passing through, the component. Various volume levels can reveal different sounds.

Ultrasonic Leak Detector

The Ultrasonic Leak Detector is used to detect wind noises caused by leaks and gaps in areas where there is weatherstripping or other sealing material. It is also used to identify A/C leaks, vacuum leaks and evaporative emission noises. The Ultrasonic Leak Detector includes a multi-directional transmitter (operating in the ultrasonic range) and a hand-held detector. The transmitter is placed inside the vehicle. On the outside of the vehicle, the hand-held detector is used to sweep the area of the suspected leak. As the source of the leak is approached, a beeping sound is produced which increases in both speed and frequency.

Squeak and Rattle Repair Kit

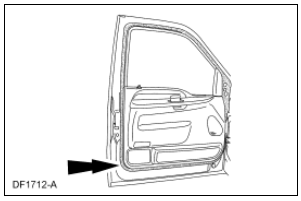
The Squeak and Rattle Repair Kit (Rotunda tool number 164-R4900) contains lubricants and self-adhesive materials that can be used to eliminate interior and exterior squeaks and rattles. The kit consists of the following materials:

- PVC (soft foam) tape

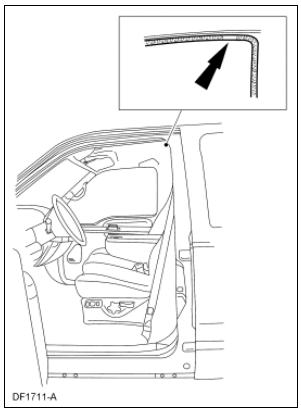
- Urethane (hard foam) tape
- Flocked (black fuzzy) tape
- UHMW (frosted) tape
- Squeak and rattle oil tube
- Squeak and rattle grease tube

Tracing Powder

Tracing powder is used to check both the uniformity of contact and the tension of a seal against its sealing surface. These tests are usually done when a suspected air leak/noise appears to originate from the seal area or during the alignment and adjustment of a component to a weatherstrip. Tracing powder can be ordered from Crest Industries as ATR Leak Trace. Carry out the tracing powder test as follows:

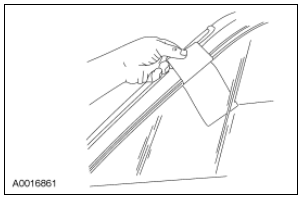


a. Clean the weatherstrip.
b. Spray the tracing powder on the mating surface only.
c. Close the door completely. Do not slam the door.
d. Open the door. An imprint is made where the weatherstrip contacted the mating surface seal. Gaps or a faint imprint will show where there is poor contact with the weatherstrip.



Index Card

Place an index card or a piece of paper between the weatherstrip and the sealing surface, then close the door. Slowly withdraw the index card or paper after the door is closed and check the amount of pressure on the weatherstrip. There should be a medium amount of resistance as it is withdrawn. Continue around the entire seal area. If there is little or no resistance, this indicates insufficient contact to form a good seal. At these points, the door, the glass or the weatherstrip is out of alignment.



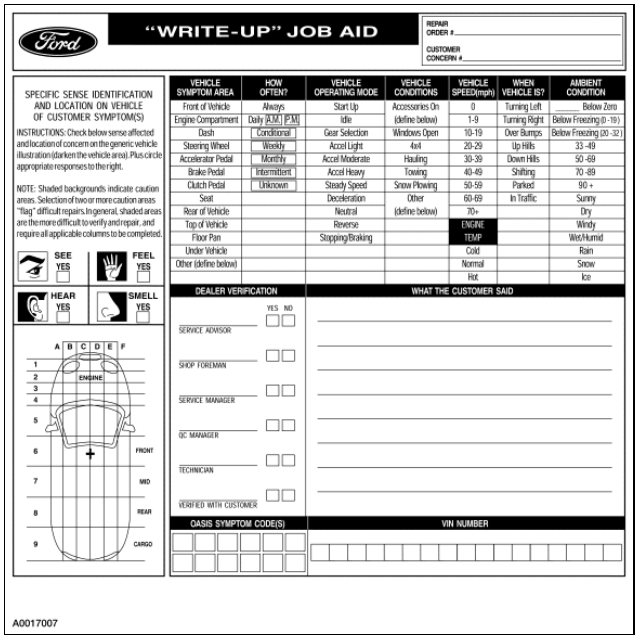
Noise, Vibration and Harshness (NVH)

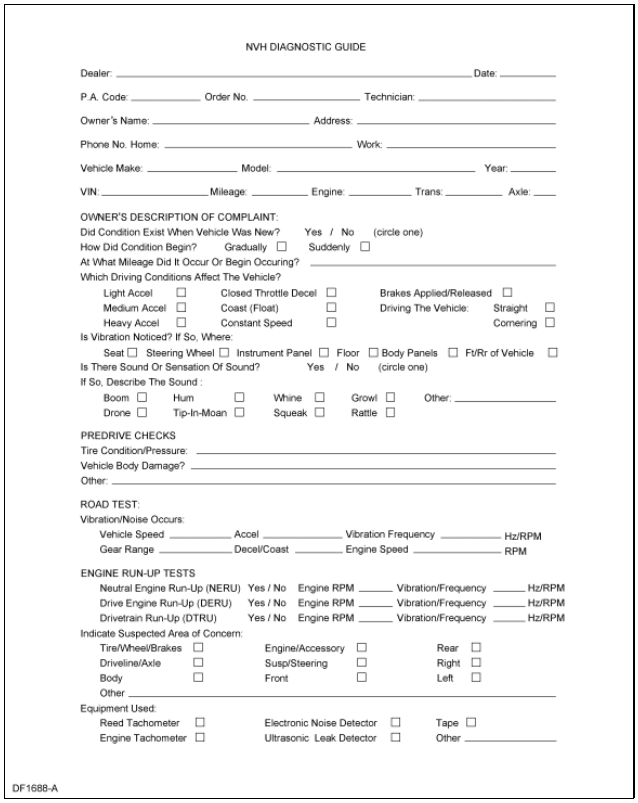
Special Tool(s)

ST2048-A	Combination EngineEar/ChassisEar 107-R2102 or Equivalent
ST2311-A	Vibration Analyzer 100-F027 (014-00344) or Equivalent
ST2312-A	EngineEar Basic Unit 107-R2100 or Equivalent
ST2314-A	Ultrasonic Leak Detector 134-R0135 or Equivalent

To assist the service advisor and the technician, a Write-up Job Aid and an NVH Diagnostic Guide are included with this material. The Write-up Job Aid serves as a place to record all important symptom information. The NVH Diagnostic Guide serves as a place to record information reported on the Write-up Job Aid as well as data from the testing to be carried out.

To begin a successful diagnosis, fill out the NVH Diagnostic Guide, record the reported findings, then proceed to each of the numbered process steps to complete the diagnosis.





NVH DIAGNOSTIC GUIDE

Dealer: _____ Date: _____

P.A. Code: _____ Order No. _____ Technician: _____

Owner's Name: _____ Address: _____

Phone No. Home: _____ Work: _____

Vehicle Make: _____ Model: _____ Year: _____

VIN: _____ Mileage: _____ Engine: _____ Trans: _____ Axle: ____

OWNER'S DESCRIPTION OF COMPLAINT:
Did Condition Exist When Vehicle Was New? Yes / No (circle one)
How Did Condition Begin? Gradually ☐ Suddenly ☐
At What Mileage Did It Occur Or Begin Occuring? _____
Which Driving Conditions Affect The Vehicle?
Light Accel ☐ Closed Throttle Decel ☐ Brakes Applied/Released ☐
Medium Accel ☐ Coast (Float) ☐ Driving The Vehicle: Straight ☐
Heavy Accel ☐ Constant Speed ☐ Cornering ☐
Is Vibration Noticed? If So, Where:
Seat ☐ Steering Wheel ☐ Instrument Panel ☐ Floor ☐ Body Panels ☐ Ft/Rr of Vehicle ☐
Is There Sound Or Sensation Of Sound? Yes / No (circle one)
If So, Describe The Sound :
Boom ☐ Hum ☐ Whine ☐ Growl ☐ Other: _____
Drone ☐ Tip-In-Moan ☐ Squeak ☐ Rattle ☐

PREDRIVE CHECKS
Tire Condition/Pressure: _____
Vehicle Body Damage? _____
Other: _____

ROAD TEST:
Vibration/Noise Occurs:
Vehicle Speed _____ Accel _____ Vibration Frequency _____ Hz/RPM
Gear Range _____ Decel/Coast _____ Engine Speed _____ RPM

ENGINE RUN-UP TESTS
Neutral Engine Run-Up (NERU) Yes / No Engine RPM _____ Vibration/Frequency _____ Hz/RPM
Drive Engine Run-Up (DERU) Yes / No Engine RPM _____ Vibration/Frequency _____ Hz/RPM
Drivetrain Run-Up (DTRU) Yes / No Engine RPM _____ Vibration/Frequency _____ Hz/RPM
Indicate Suspected Area of Concern:
Tire/Wheel/Brakes ☐ Engine/Accessory ☐ Rear ☐
Driveline/Axle ☐ Susp/Steering ☐ Right ☐
Body ☐ Front ☐ Left ☐
Other _____
Equipment Used:
Reed Tachometer ☐ Electronic Noise Detector ☐ Tape ☐
Engine Tachometer ☐ Ultrasonic Leak Detector ☐ Other _____

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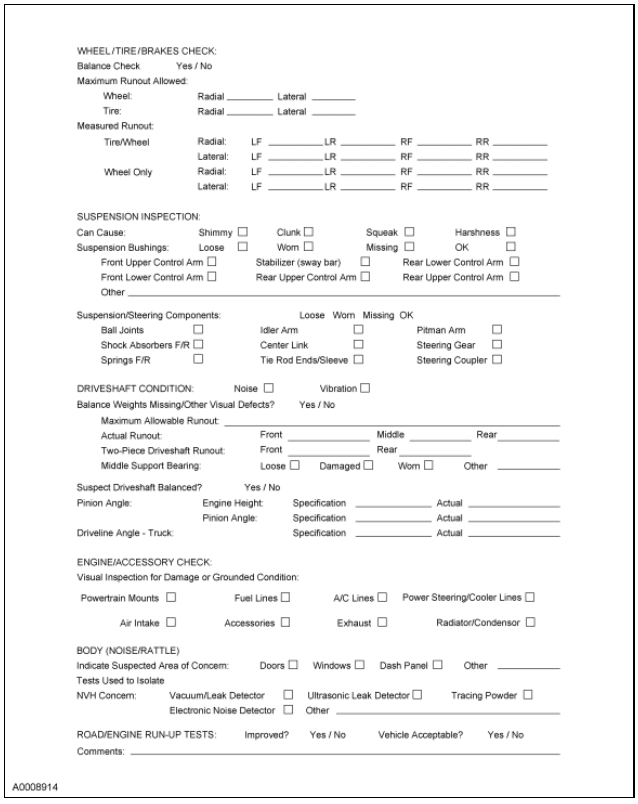

WHEEL/TIRE/BRAKES CHECK:
Balance Check Yes / No
Maximum Runout Allowed:
Wheel: Radial _____ Lateral _____
Tire: Radial _____ Lateral _____
Measured Runout:
Tire/Wheel Radial: LF _____ LR _____ RF _____ RR _____
Lateral: LF _____ LR _____ RF _____ RR _____
Wheel Only Radial: LF _____ LR _____ RF _____ RR _____
Lateral: LF _____ LR _____ RF _____ RR _____

SUSPENSION INSPECTION:
Can Cause: Shimmy ☐ Clunk ☐ Squeak ☐ Harshness ☐
Suspension Bushings: Loose ☐ Worn ☐ Missing ☐ OK ☐
Front Upper Control Arm ☐ Stabilizer (sway bar) ☐ Rear Lower Control Arm ☐
Front Lower Control Arm ☐ Rear Upper Control Arm ☐ Rear Upper Control Arm ☐
Other _____

Suspension/Steering Components: Loose Worn Missing OK
Ball Joints ☐ Idler Arm ☐ Pitman Arm ☐
Shock Absorbers F/R ☐ Center Link ☐ Steering Gear ☐
Springs F/R ☐ Tie Rod Ends/Sleeve ☐ Steering Coupler ☐

DRIVESHAFT CONDITION: Noise ☐ Vibration ☐
Balance Weights Missing/Other Visual Defects? Yes / No
Maximum Allowable Runout: _____
Actual Runout: Front _____ Middle _____ Rear _____
Two-Piece Driveshaft Runout: Front _____ Rear _____
Middle Support Bearing: Loose ☐ Damaged ☐ Worn ☐ Other _____

Suspect Driveshaft Balanced? Yes / No
Pinion Angle: Engine Height: Specification _____ Actual _____
Pinion Angle: Specification _____ Actual _____
Driveline Angle - Truck: Specification _____ Actual _____

ENGINE/ACCESSORY CHECK:
Visual Inspection for Damage or Grounded Condition:
Powertrain Mounts ☐ Fuel Lines ☐ A/C Lines ☐ Power Steering/Cooler Lines ☐
Air Intake ☐ Accessories ☐ Exhaust ☐ Radiator/Condensor ☐

BODY (NOISE/RATTLE)
Indicate Suspected Area of Concern: Doors ☐ Windows ☐ Dash Panel ☐ Other _____
Tests Used to Isolate
NVH Concern: Vacuum/Leak Detector ☐ Ultrasonic Leak Detector ☐ Tracing Powder ☐
Electronic Noise Detector ☐ Other _____

ROAD/ENGINE RUN-UP TESTS: Improved? Yes / No Vehicle Acceptable? Yes / No
Comments: _____

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1: Customer Interview

The diagnostic process starts with the customer interview. The service advisor must obtain as much information as possible about the problem and take a test drive with the customer. There are many ways a customer will describe NVH concerns and this will help minimize confusion arising from descriptive language differences. It is important that the concern is correctly interpreted and the customer descriptions are

recorded. During the interview, ask the following questions:

- When was it first noticed?
- Did it appear suddenly or gradually?
- Did any abnormal occurrence coincide with or proceed its appearance?

Use the information gained from the customer to accurately begin the diagnostic process.

2: Pre-Drive Check

It is important to do a pre-drive check before road testing the vehicle. A pre-drive check verifies that the vehicle is relatively safe to drive and eliminates any obvious faults on the vehicle.

The pre-drive check consists of a brief visual inspection. During this brief inspection, take note of anything that will compromise safety during the road test and make those repairs/adjustments before taking the vehicle on the road.

3: Preparing for the Road Test

Observe the following when preparing for the road test:

- Review the information recorded on the NVH Diagnostic Guide. It is important to know the specific concern the customer has with the vehicle.
- Do not be misled by the reported location of the noise/vibration. The cause can actually be some distance away.
- Remember that the vibrating source component (originator) may only generate a small vibration. This small vibration can in turn cause a larger vibration/noise to emanate from another receiving component (reactor), due to contact with other components (transfer path).
- Conduct the road test on a quiet street where it is safe to duplicate the vibration/noise. The ideal testing route is an open, low-traffic area where it is possible to operate the vehicle at the speed in which the condition occurs.
- If possible, lower the radio antenna in order to minimize turbulence. Identify anything that could potentially make noise or be a source of wind noise. Inspect the vehicle for add-on items that create vibration/noise. Turn OFF the radio and the heating and cooling system blower.
- The engine speed is an important factor in arriving at a final conclusion. Therefore, connect an accurate tachometer to the engine, even if the vehicle has a tachometer. Use a tachometer that has clearly defined increments of less than 50 rpm. This ensures an exact engine speed reading.

4: Verify the Customer Concern

Verify the customer concern by carrying out a road test, an engine run-up test, or both.

The decision to carry out a road test, an engine run-up test, or both depends on the type of NVH concern. A road test may be necessary if the symptom relates to the suspension system or is sensitive to torque. A drive engine run-up (DERU) or a neutral engine run-up (NERU) test identifies noises and vibrations relating to engine and drivetrain rpm. Remember, a condition will not always be identifiable by carrying out these tests, however, they will eliminate many possibilities if carried out correctly.

5: Road Test

NOTE: It may be necessary to have the customer ride along or drive the vehicle to point out the concern. During the road test, take into consideration the customer's driving habits and the driving conditions. The customer's concern just may be an acceptable operating condition for that vehicle.

The following is a brief overview of each test in the order in which it appears. A review of this information helps to quickly identify the most appropriate process necessary to make a successful diagnosis. After reviewing this information, select and carry out the appropriate test(s), proceeding to the next step of this process.

- The Slow Acceleration Test is normally the first test to carry out when identifying an NVH concern, especially when a road test with the customer is not possible.
- The Heavy Acceleration Test helps to determine if the concern is torque-related.
- The Neutral Coast Down Speed Test helps to determine if the concern is vehicle speed-related.
- The Downshift Speed Test helps to determine if the concern is engine speed-related.
- The Steering Input Test helps to determine how the wheel bearings and other suspension components contribute to a vehicle speed-related concern.
- The Brake Test helps to identify vibrations or noise that are brake related.
- The Road Test Over Bumps helps isolate a noise that occurs when driving over a rough or bumpy surface.
- The Engine Run-Up Tests consist of the Neutral Run-Up Test and the Engine Load Test. These tests help to determine if the concern is engine speed-related.
- The Neutral Run-Up Test is used as a follow-up test to the Downshift Speed Test when the concern occurs at idle.
- The Engine Load Test helps to identify vibration/noise sensitive to engine load or torque. It also helps to reproduce engine speed-related concerns that cannot be duplicated when carrying out the Neutral Run-Up Test or the Neutral Coast Down Test.
- The Engine Accessory Test helps to locate faulty belts and accessories that cause engine speed-related concerns.
- The Vehicle Cold Soak Procedure helps to identify concerns occurring during initial start-up and when an extended time lapse occurs between vehicle usage.

Slow Acceleration Test

To carry out this test, proceed as follows:

- Slowly accelerate to the speed where the reported concern occurs. Note the vehicle speed, the engine rpm and, if possible, determine the vibration frequency.
- Attempt to identify from what part of the vehicle the concern is coming.
- Attempt to identify the source of the concern.
- Proceed as necessary.

Heavy Acceleration Test

To carry out this test, proceed as follows:

- Accelerate hard from 0-64 km/h (0-40 mph).
- Decelerate in a lower gear.
- The concern is torque related if duplicated while carrying out this test.
- Proceed as necessary.

Neutral Coast Down Speed Test

To carry out this test, proceed as follows:

- Drive at a higher rate of speed than where the concern occurred when carrying out the Slow Acceleration Test.
- Place the transmission in NEUTRAL and coast down past the speed where the concern occurs.
- The concern is vehicle speed-related if duplicated while carrying out this test. This eliminates the engine and the torque converter as sources.
- If the concern was not duplicated while carrying out this test, carry out the Downshift Speed Test to verify if the concern is engine speed related.
- Proceed as necessary.

Downshift Speed Test

To carry out this test, proceed as follows:

- Shift into a lower gear than the gear used when carrying out the Slow Acceleration Test.
- Drive at the engine rpm where the concern occurs.
- The concern is engine speed related if duplicated while carrying out this test. This eliminates the tires, wheels, brakes and the suspension components as sources.
- If necessary, repeat this test using other gears and NEUTRAL to verify the results.
- Proceed as necessary.

Steering Input Test

To carry out this test, proceed as follows:

- Drive at the speed where the concern occurs, while making sweeping turns in both directions.
- If the concern goes away or gets worse, the wheel bearings, hubs, U-joints (contained in the axles of 4WD applications), and tire tread wear are all possible sources.
- Proceed as necessary.

Brake Test

To carry out this test, proceed as follows:

- Warm the brakes by slowing the vehicle a few times from 80â— 32 km/h (50â— 20 mph) using light braking applications. At highway speeds of 89â— 97 km/h (50â— 60 mph), apply the brake using a light pedal force.
- Accelerate to 89â— 97 km/h (55â— 60 mph).
- Lightly apply the brakes and slow the vehicle to 30 km/h (20 mph).
- A brake vibration noise can be felt in the steering wheel, seat or brake pedal. A brake noise can be heard upon brake application and diminish when the brake is released.

Road Test Over Bumps

To carry out this test, proceed as follows:

- Drive the vehicle over a bump or rough surface one wheel at a time to determine if the noise is coming from the front or the back and the left or the right side of the vehicle.
- Proceed as necessary.

Neutral Engine Run-Up (NERU) Test

To carry out this test, proceed as follows:

- Install a tachometer.

- Increase the engine rpm up from an idle to approximately 4000 rpm while in PARK on front wheel drive vehicles with automatic transmissions, or NEUTRAL for all other vehicles. Note the engine rpm and, if possible, determine the vibration frequency.
- Attempt to identify what part of the vehicle the concern is coming from.
- Attempt to identify the source of the concern.
- Proceed as necessary.

Drive Engine Run-Up (DERU) Load Test

To carry out this test, proceed as follows:

- **⚠ WARNING: Block the front and rear wheels, and apply the parking brake and the service brake, or injury to personnel can result.**

  ⚠ CAUTION: Do not carry out the Engine Load Test for more than 5 seconds or damage to the transmission or transaxle can result.

  Block the front and rear wheels.
- Apply the parking brake and the service brake.
- Install a tachometer.
- Shift the transmission into DRIVE, and increase and decrease the engine rpm between an idle to approximately 2000 rpm. Note the engine rpm and, if possible, determine the vibration frequency.
- Repeat the test in REVERSE.
- If the vibration/noise is duplicated when carrying out this test, inspect the engine and transmission or transaxle mounts.
- If the concern is definitely engine speed-related, carry out the Engine Accessory Test to narrow down the source.
- Proceed as necessary.

Engine Accessory Test

To carry out this test, proceed as follows:

- **⚠ WARNING: Block the front and rear wheels, and apply the parking brake and the service brake, or injury to personnel can result.**

  ⚠ CAUTION: Limit engine running time to one minute or less with belts removed or serious engine damage will result.

  NOTE: A serpentine drive belt decreases the usefulness of this test. In these cases, use a vibration analyzer, such as the vibration analyzer (VA), to pinpoint accessory vibrations. An electronic listening device, such as an EngineEAR, will also help to identify noises from specific accessories.

  Remove the accessory drive belts.
- Increase the engine rpm to where the concern occurs.
- If the vibration/noise is duplicated when carrying out this test, the belts and accessories are not sources.
- If the vibration/noise was not duplicated when carrying out this test, install each accessory belt, one at a time, to locate the source.

Vehicle Cold Soak Procedure

To carry out this procedure, proceed as follows:

- Test preparations include matching customer conditions (if known). If not known, document the test conditions: gear selection and engine rpm. Monitor the vibration/noise duration with a watch for up to 3 minutes.
- Park the vehicle where testing will occur. The vehicle must remain at or below the concern temperature (if known) for 6-8 hours.
- Before starting the engine, conduct a visual inspection under the hood.
- Turn the key on, but do not start the engine. Listen for the fuel pump, anti-lock brake system (ABS) and air suspension system noises.
- Start the engine.
- ⚠ **CAUTION: Never probe moving parts.**

  Isolate the vibration/noise by carefully listening. Move around the vehicle while listening to find the general location of the vibration/noise. Then, search for a more precise location by using a stethoscope or EngineEAR.
- Refer to Idle Noise/Vibration in the Symptom Chart to assist with the diagnosis.

6: Check OASIS/TSBs/Repair History

After verifying the customer concern, check for OASIS reports, TSBs and the vehicle repair history for related concerns. If information relating to a diagnosis/repair is found, carry out the procedure(s) specified in that information.

If no information is available from these sources, carry out the vehicle preliminary inspection to eliminate any obvious faults.

7: Diagnostic Procedure

Qualifying the concern by the particular sensation present can help narrow down the concern. Always use the "symptom" to "system" to "component" to "cause" diagnosis technique. This diagnostic method divides the problem into related areas to correct the customer concern.

- Verify the "symptom".
- Determine which "system(s)" can cause the "symptom".
  - ♦ If a vibration concern is vehicle speed related, the tire and wheel rpm/frequency or driveshaft frequency should be calculated.
  - ♦ If a vibration concern is engine speed related, the engine, engine accessory or engine firing frequencies should be calculated.
- After determining the "system", use the diagnostic tools to identify the worn or damaged "components".
- After identifying the "components", try to find the "cause" of the failure.

Once the concern is narrowed down to a symptom/condition, proceed to NVH Condition and Symptom Categories.

NVH Condition and Symptom Categories

A good diagnostic process is a logical sequence of steps that lead to the identification of a causal system. Use the condition and symptom categories as follows:

- Identify the operating condition that the vehicle is exhibiting.
- Match the operating condition to the symptom.

- Verify the symptom.
- Identify which category or system could cause the symptom.
- Refer to the diagnostic symptom chart that is referred to.

Operating Condition — Vehicle is Not Moving

1. Static operation
    - Noise occurs during component/system functioning. GO to Symptom Chart .

2. While cranking
    1. Grinding or whine, differential ring gear or starter motor pinion noise. GO to Symptom Chart .
    2. Rattle. Exhaust hanger, exhaust heat shield or A/C line noise. GO to Symptom Chart .
    3. Vibration. Acceptable condition.

3. At idle
    - Idle noise. GO to Symptom Chart .
    - Idle vibration or shake. GO to Symptom Chart .

4. During Gear Selection
    1. Vehicle parked on a steep incline. Acceptable noise.
    2. Vehicle parked on a flat surface. GO to Symptom Chart .

Operating Condition — Vehicle is Moving

1. Depends more on how the vehicle is operated
    1. Speed related
        - Related to vehicle speed
            - Pitch increases with vehicle speed. GO to Symptom Chart .
            - Noise occurs at specific vehicle speed. A high-pitched noise (whine). GO to Symptom Chart .
            - Loudness proportional to vehicle speed. Low-frequency noise at high speeds, noise and loudness increase with speed. GO to Symptom Chart .
            - A low-pitched noise (drumming). GO to Symptom Chart .
            - Vibration occurs at a particular speed (mph) regardless of acceleration or deceleration. GO to Symptom Chart .
            - Noise varies with wind/vehicle speed and direction. GO to Symptom Chart .
        - Related to engine speed.
            - Noise varies with engine rpm. GO to Symptom Chart .
            - Vibration occurs at a particular speed (mph) regardless of engine speed (rpm).
    2. Acceleration
        - Wide open throttle (WOT)
            - Engine induced contact between components. Inspect and repair as necessary.
            - Noise is continuous throughout WOT. Exhaust system or engine ground out. GO to Symptom Chart .
        - Light/moderate acceleration
            - Tip-in moan. Engine/exhaust noise. GO to Symptom Chart .
            - Knock-type noise. GO to Symptom Chart .
            - Driveline shudder. GO to Symptom Chart .
            - Engine vibration. GO to Symptom Chart .
    3. Turning noise GO to Symptom Chart .
    4. Braking

- Clicking sound is signaling ABS is active. Acceptable ABS sound.
- A continuous grinding/squeal. GO to Symptom Chart .
- Brake vibration/shudder. GO to Symptom Chart .

5. Shifting
   - Noise or vibration condition related to the transmission (automatic). GO to Symptom Chart .
6. Cruising speeds
   - Accelerator pedal vibration. GO to Symptom Chart .
   - Driveline vibration. GO to Symptom Chart .
   - A shimmy or shake. GO to Symptom Chart .
7. Driving at low/medium speeds
   - A wobble or shudder. GO to Symptom Chart .

2. Depends more on where the vehicle is operated
   1. Bump/pothole, rough road or smooth road. GO to Symptom Chart .
      - Noise is random or intermittent occurring from road irregularities. GO to Symptom Chart .
      - Noise or vibration changes from one road surface to another. Normal sound changes.
      - Noise or vibration associated with a hard/firm ride. GO to Symptom Chart .

Symptom Charts

Symptom Chart — Air Leak and Wind Noise

Symptom Chart — Brake Noise/Vibration

Symptom Chart — Driveline Noise/Vibration

Symptom Chart — Engine Noise/Vibration

Symptom Chart — Idle Noise/Vibration

Symptom Chart — Squeak and Rattle

Symptom Chart — Steering Noise/Vibration

Symptom Chart — Suspension Noise/Vibration

Symptom Chart — Tire Noise/Vibration

Symptom Chart — Transmission (Automatic) Noise/Vibration

Pinpoint Tests

The pinpoint tests are a step-by-step diagnostic process designed to determine the cause of a condition. It may not always be necessary to follow a pinpoint test to its conclusion. Carry out only the steps necessary to correct the condition. Then, test the system for normal operation. Sometimes, it is necessary to remove various vehicle components to gain access to the component requiring testing. For additional information, refer to the appropriate section for removal and installation procedures. Reinstall all components after verifying system operation is normal.

PINPOINT TEST A: BRAKE VIBRATION/SHUDDER

Test Step	Result / Action to Take
A1 ROAD TEST THE VEHICLE — LIGHT BRAKING	
• Check that the wheel and tires are correct for the vehicle. Inspect the tires for abnormal wear patterns. • Road test the vehicle. Warm the brakes by slowing the vehicle a few times from 80-32 km/h (50 to 20 mph) using light braking applications. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using a light pedal force. • **Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?**	**Yes** GO to A4 . **No** GO to A2 .
A2 ROAD TEST THE VEHICLE — MODERATE TO HEAVY BRAKING	
• Road test the vehicle. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force. • **Is there a vibration/shudder?**	**Yes** For vehicles with ABS, GO to A3 . For vehicles with standard brakes, GO to A4 . **No** Vehicle is OK. VERIFY condition with customer. TEST the vehicle for normal operation.
A3 NORMAL ACTUATION OF THE ABS SYSTEM DIAGNOSIS	
• During moderate to heavy braking, noise from the hydraulic control unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS system. Pedal pulsation or steering wheel nibble (frequency is proportioned to the vehicle speed) indicates a concern with a brake or suspension component. • **Is the vibration/shudder vehicle speed sensitive?**	**Yes** GO to A5 . **No** The brake system is operating correctly.
A4 APPLICATION OF THE PARKING BRAKE	
• **NOTE:** Begin at the front of the vehicle unless the vibration or shudder has been isolated to the rear. • This test is not applicable to vehicles with drum-in-hat type parking brakes. For vehicles with drum-in-hat parking brakes, proceed to the next test. For all other vehicles, apply the parking brake to identify if the problem is in the front or rear brake. At highway speeds of 89-97 km/h (55-60 mph), lightly apply the parking brake until the vehicle slows down. Release the parking brake immediately after the test. • **Is there a vibration/shudder?**	**Yes** GO to A8 . **No** GO to A5 .
A5 CHECK THE FRONT WHEEL BEARINGS	

• Check the front wheel bearings. Refer to Wheel Bearing Check in this section. • **Are the wheel bearings OK?**	**Yes** GO to A6 . **No** INSPECT the wheel bearings. ADJUST or REPAIR as necessary. TEST the system for normal operation.
A6 CHECK THE FRONT SUSPENSION	
• Check the front suspension for: ♦ broken or loose bolts. ♦ damaged springs. ♦ worn or damaged upper and lower control arm bushings. ♦ loose or rough front bearings. ♦ uneven tire wear. • **Are all the suspension components in satisfactory condition?**	**Yes** GO to A7 . **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
A7 RESURFACE THE FRONT BRAKE DISCS	
• ⚠ **CAUTION: Do not use a bench lathe to machine brake discs.** • **NOTE:** Follow the manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification. • Resurface the front brake discs or drums. Refer to Section 206-03 . Road test the vehicle. • **Is the vibration/shudder present?**	**Yes** GO to A8 . **No** Vehicle is OK.
A8 CHECK THE REAR SUSPENSION	
• Check the rear suspension for: ♦ broken or loose bolts. ♦ damaged or worn springs or spring bushings. ♦ worn or damaged upper and lower control arm bushings. ♦ worn or damaged trailing arms. ♦ loose or rough rear bearings. ♦ uneven tire wear. • **Are all the suspension components in satisfactory condition?**	**Yes** GO to A9 . **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
A9 RESURFACE THE REAR BRAKE DISC OR DRUM	
• ⚠ **CAUTION: Do not use a bench lathe to machine brake discs.** • **NOTE:** Follow the manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification. • Resurface the front brake discs. Refer to Section 206-00 . Road test the vehicle. • **Is the vibration/shudder present?**	**Yes** CHECK the front suspension for wear or damage. RESURFACE the front brake discs. TEST the system for normal operation. **No** Vehicle is OK.

PINPOINT TEST B: ENGINE TICKING NOISE

Test Step	Result / Action to Take
B1 CHECK FOR TICKING NOISE AT THE FUEL RAIL	
• Disconnect the first fuel line clip. • **Is the ticking noise gone?**	**Yes** CHECK for TSB for applicable vehicle. REPAIR as necessary. TEST the system for normal operation. **No** GO to B2 .
B2 CHECK FOR TICKING NOISE AT THE FUEL INJECTOR	
• Using an EngineEAR, listen at the fuel injectors by placing a probe on each injector. To isolate the faulty injector, disconnect the injector electrical connector and listen for the noise. • **Is the fuel injector the source of the ticking noise?**	**Yes** INSTALL a new fuel injector. REFER to Section 303-04 . TEST the system for normal operation. **No** GO to B3 .
B3 CHECK THE BELT TENSIONER FOR TICKING NOISE	
• Inspect the accessory drive. Check for the belt tensioner bottoming at end of travel or not at end of stroke. • Using an EngineEAR, listen at the belt tensioner. • **Is the belt tensioner the source of the noise?**	**Yes** INSTALL a new belt tensioner. TEST the system for normal operation. **No** GO to B4 .
B4 CHECK THE WATER PUMP FOR TICKING NOISE	
• Using an EngineEAR, listen at the water pump for ticking noise. • **Is the water pump the source of the noise?**	**Yes** INSTALL a new water pump. REFER to Section 303-03 . TEST the system for normal operation. **No** GO to B5 .
B5 CHECK FOR AN OBSTRUCTION OF THE COOLING FAN	
• Inspect the cooling fan for obstructions. • Check the cooling fan and shroud for wear or damage. • **Was there an obstruction or does the cooling fan show signs of damage?**	**Yes** REPAIR or INSTALL a new cooling fan. REFER to Section 303-03 . TEST the system for normal operation. **No** GO to B6 .
B6 CHECK THE OIL PUMP FOR TICKING NOISE	
• Check the oil pump using EngineEARs and probe at the oil filter adapter to verify the oil pump as a source. • **Is the oil pump the source of the noise?**	**Yes** INSTALL a new oil pump. REFER to Section 303-01 . TEST the system for normal operation.

	No GO to B7 .
B7 CHECK VALVE LIFTERS OR LASH ADJUSTERS FOR CORRECT OPERATION	
• Check valve lifter/lash adjuster for correct operation, using EngineEARs. • **Are the valve lifters/lash adjusters operating correctly?**	**Yes** VERIFY customer concern. CONDUCT a diagnosis of other suspect components. **No** INSTALL a new valve lifter/lash adjuster(s). TEST the system for normal operation.

PINPOINT TEST C: ACCESSORY DRIVE BEARING HOOT

Test Step	Result / Action to Take
C1 CHECK THE ACCESSORY DRIVE IDLER AND TENSIONER PULLEY BEARINGS	
• Carry out the Vehicle Cold Soak Procedure in this section. • Start the engine. • Place an EngineEAR probe directly on the pulley center post or bolt to verify which bearing is making the noise. • Ignition OFF. • **Is either bearing making the noise?**	**Yes** INSTALL a new pulley/idler. CARRY OUT the Vehicle Cold Soak Procedure and TEST the system for normal operation. **No** CONDUCT a diagnosis on other suspect accessory drive components.

PINPOINT TEST D: POWER STEERING MOAN

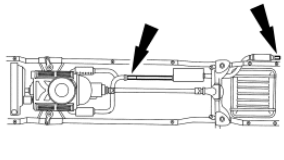
Test Step	Result / Action to Take
D1 CHECK THE POWER STEERING SYSTEM	
• Carry out the Vehicle Cold Soak Procedure in this section. • Start the engine. • Turn the steering wheel while the noise is occurring and listen for changes in sound pitch or loudness. • Ignition OFF. • **Does the sound pitch or loudness change while turning the steering wheel?**	**Yes** GO to D2 . **No** CONDUCT a diagnosis on other suspect accessory drive components.
D2 VERIFY THE SOURCE	
• Start the engine. • Place an EngineEAR probe near the power steering pump/reservoir while the noise is occurring. While an assistant turns the	**Yes** VERIFY that the supply tube to the pump is unobstructed. CHECK the fluid condition and level. DRAIN the fluid and REFILL. REFER to Section 211-00 . CARRY OUT the Vehicle Cold

steering wheel, listen for changes in sound pitch or loudness. • Ignition OFF. • **Does the sound pitch or loudness change while turning the steering wheel?**	Soak Procedure and TEST the system for normal operation. **No** Normal system operation.

PINPOINT TEST E: ENGINE DRIVEN COOLING FAN MOAN

Test Step	Result / Action to Take
E1 CHECK THE ENGINE DRIVEN COOLING FAN AFTER A COLD SOAK	
• Carry out the Vehicle Cold Soak Procedure in this section. • Start the engine. • Assess the airflow. • Raise the engine speed to 1500 rpm while listening for the moan to increase in proportion to the airflow. • Ignition OFF. • **Does the moan increase in proportion to the airflow?**	**Yes** TEST the fan for normal operation. If the fan tests normal, GO to E2 . Otherwise, REPAIR as necessary. **No** Normal system operation.
E2 CHECK THE ENGINE DRIVEN COOLING FAN AT NORMAL OPERATING TEMPERATURE	
• Start the engine. • Run the engine to normal operating temperature while listening for the moan to stop. • Ignition OFF. • **Does the moan stop?**	**Yes** Normal clutch operation. **No** INSTALL a new fan clutch. TEST the system for normal operation.

PINPOINT TEST F: DRUMMING NOISE

Test Step	Result / Action to Take
F1 CHECK THE EXHAUST SYSTEM	
• Start the engine. • Increase the engine rpm until the noise is the loudest. Note the engine rpm. • Ignition OFF. • Add approximately 9 kg (20 lb) of weight to the exhaust system. First place the weight at the tail pipe and test, then place it at the front pipe.  DF1768-A	**Yes** CARRY OUT Exhaust System Neutralizing in this section. TEST the system for normal operation. **No** GO to F2 .

• Start the engine. • Increase the engine rpm and listen for the drumming noise. Note the engine rpm if the noise occurs. • Ignition OFF. • Using a vibration analyzer (VA), determine the amount of vibration that occurs with the drumming noise. • **Is the noise/vibration reduced or eliminated, or does the noise/vibration occur at a different rpm?**	
F2 POWERTRAIN/DRIVETRAIN MOUNT NEUTRALIZING	
• Carry out Powertrain/Drivetrain Mount Neutralizing in this section. Test the system for normal operation. • **Is the noise reduced or eliminated?**	**Yes** Vehicle OK. TEST the system for normal operation. **No** CONDUCT diagnosis of other suspect components.

PINPOINT TEST G: ENGINE TICKING, KNOCKING OR CONTINUOUS RATTLE

Test Step	Result / Action to Take
G1 CHECK FOR NOISE AT THE VALVE COVERS AND THE FRONT COVERS (OHC ENGINES)	
• Carry out the Vehicle Cold Soak Procedure in this section. • Start the engine. • **NOTE:** For a short-duration ticking noise, multiple engine starts may be necessary. • Using an EngineEAR, listen closely at the valve covers and the front covers (OHC engines) by placing the probe near the surface of the valve cover and then on the surface front cover. • Ignition OFF. • **Is the noise source apparent?**	**Yes** REMOVE the appropriate cover and INSPECT for loose, worn/broken components. REPAIR as necessary. TEST the system for normal operation. **No** GO to G2 .
G2 CHECK FOR NOISE AT THE CYLINDER BLOCK	
• Start the engine. • Using an EngineEAR, listen closely at the cylinder block by placing a probe on or near each freeze plug. • Ignition OFF. • **Is the noise source apparent?**	**Yes** REPAIR or INSTALL new components as necessary. **No** GO to G3 .
G3 CHECK FOR NOISE WHILE DISCONNECTING EACH FUEL INJECTOR ELECTRICAL CONNECTOR, ONE AT A TIME	
• Start the engine. • Disconnect each fuel injector electrical connector, one at a time, to decrease piston force and listen for the noise. • Ignition OFF. • **Is the noise reduced or eliminated?**	**Yes** INSTALL a new fuel injector. REFER to Section 303-04 . TEST the system for normal operation. **No** INSPECT accessory drive or the transmission as a possible source.

PINPOINT TEST H: FRONT SUSPENSION NOISE

Test Step	Result / Action to Take
H1 ROAD TEST THE VEHICLE	
• Test drive the vehicle. • **NOTE:** An assistant will be needed for this road test. • During the road test, drive the vehicle over a rough road. Using ChassisEARs, determine from which area/component the noise is originating. • **Is there a squeak, creak or rattle noise?**	**Yes** GO to H2 . **No** The suspension system is OK. CONDUCT a diagnosis on other suspect systems.
H2 INSPECT THE STEERING SYSTEM	
• ⚠ **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.** • Raise and support the vehicle. • Check the steering system for wear or damage. Carry out a steering linkage test. Refer to Section 211-00 . • Inspect the tire wear pattern. Refer to Tire Wear Chart in Tire Wear Patterns and Frequency Calculations in this section. • **Are the steering components worn or damaged?**	**Yes** REPAIR the steering system. INSTALL new components as necessary. TEST the system for normal operation. **No** GO to H3 .
H3 FRONT SHOCK ABSORBER/STRUT CHECK	
• Check the front shock absorbers/strut mounts for loose bolts or nuts. • Check the front shock absorbers/struts for wear or damage. Carry out a "bounce test". • **Are the front shock absorbers/struts loose or damaged?**	**Yes** TIGHTEN to specifications if loose. INSTALL new front shock absorbers/struts if damaged. TEST the system for normal operation. **No** GO to H4 .
H4 CHECK THE FRONT SPRINGS	
• Check the front spring and front spring mounts/brackets for wear or damage. • **Are the front springs or spring mounts/brackets worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** GO to H5 .
H5 CHECK THE CONTROL ARMS/RADIUS ARMS	
• Inspect the control arm bushings for wear or damage. • Inspect for twisted or bent control arms/radius arms. • **Are the control arms/radius arms damaged or worn?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal

	operation. **No** GO to H6 .
H6 CHECK THE STABILIZER BAR/TRACK BAR	
• Check the stabilizer bar/track bar bushings and links for damage or wear. • Check the stabilizer bar/track bar for damage. • Check for loose or damaged stabilizer bar isolators or brackets. • **Are the stabilizer bar/track bar components loose, worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** Suspension system OK. CONDUCT diagnosis on other suspect systems.

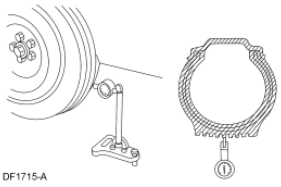
PINPOINT TEST I: REAR SUSPENSION NOISE

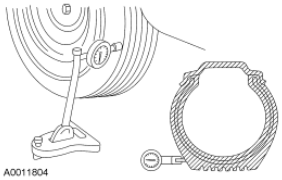
Test Step	Result / Action to Take
I1 ROAD TEST THE VEHICLE	
• Test drive the vehicle. • **NOTE:** An assistant will be needed for this road test. • During the road test, drive the vehicle over a rough road. Using ChassisEARs, determine from which area/component the noise is originating. • **Is there a squeak, creak or rattle noise?**	**Yes** GO to I2 . **No** The suspension system is OK. CONDUCT a diagnosis on other suspect systems.
I2 REAR SHOCK ABSORBER/STRUT CHECK	
• ⚠ **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.** • Raise and support the vehicle. • Check the rear shock absorber/strut mounts for loose bolts or nuts. • Check the rear shock absorbers/struts for damage. Carry out a shock absorber check. • **Are the rear shock absorbers/struts loose or damaged?**	**Yes** TIGHTEN to specifications if loose. INSTALL new rear shock absorbers/struts if damaged. TEST the system for normal operation. **No** GO to I3 .
I3 CHECK THE REAR SPRINGS	
• Check the rear springs and rear spring mounts/brackets for wear or damage. • **Are the rear springs or spring mounts/brackets worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** GO to I4 .

I4 CHECK THE CONTROL ARMS/TRAILING ARMS	
• Inspect the control arm/trailing arm bushings for wear or damage. Check for loose control arm/trailing arm bolts. • Inspect for twisted or bent control arms/trailing arms. • **Are the control arms/trailing arms loose, damaged or worn?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** GO to I5 .
I5 CHECK THE STABILIZER BAR/TRACK BAR	
• Check the stabilizer bar/track bar bushings and links for damage or wear. • Check the stabilizer bar/track bar for damage. • Check for loose or damaged stabilizer bar isolators or brackets. • **Are the stabilizer bar/track bar components loose, worn or damaged?**	**Yes** REPAIR or INSTALL new components as necessary. Test the system for normal operation. **No** Suspension system OK. CONDUCT diagnosis on other suspect systems.

PINPOINT TEST J: WHEEL AND TIRE

Test Step	Result / Action to Take
J1 ROAD TEST THE VEHICLE	
• **NOTE:** Wheel or tire vibrations felt in the steering wheel are most likely related to the front wheel or tire. Vibration felt through the seat are most likely related to the rear wheel or tire. This may not always be true, but it can help to isolate the problem to the front or rear of the vehicle. • Test drive the vehicle at different speed ranges. • During the road test, if the vibration can be eliminated by placing the vehicle in NEUTRAL or is affected by the speed of the engine, the cause is not the wheels or tires. • **Is there a vibration and noise?**	**Yes** GO to J2 . **No** The wheel and tires are OK. CONDUCT a diagnosis on other suspect systems.
J2 CHECK THE FRONT WHEEL BEARINGS	
• Check the front wheel bearings. Refer to Wheel Bearing Check in this section. • **Are the wheel bearings OK?**	**Yes** GO to J3 . **No** INSPECT the wheel bearings. ADJUST or REPAIR as necessary. TEST the system for normal operation.
J3 INSPECT THE TIRES	
• Check the tires for missing weights. • Check the wheels for damage. • Inspect the tire wear pattern. Refer to the Tire Wear Patterns chart in this section.	**Yes** CORRECT the condition that caused the abnormal wear. INSTALL new tire(s). TEST the system for normal

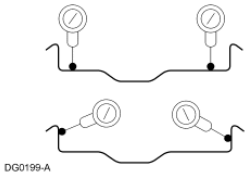
• **Do the tires have an abnormal wear pattern?**	operation. **No** GO to J4 .
J4 TIRE ROTATION DIAGNOSIS	
• Spin the tires slowly and watch for signs of lateral runout. DF1713-A • Spin the tires slowly and watch for signs of radial runout. DF1714-A • **Are there signs of visual runout?**	**Yes** GO to J5 . **No** CHECK the wheel and tire balance. CORRECT as necessary. TEST the system for normal operation.
J5 RADIAL RUNOUT CHECK ON THE TIRE	
• Measure the radial runout of the wheel and tire assembly. A typical specification for total radial runout is 1.14 mm (0.04 in).  DF1715-A • **Is the radial runout within specifications?**	**Yes** GO to J8 . **No** GO to J6 .
J6 RADIAL RUNOUT CHECK ON THE WHEEL	
• Measure the radial runout of the wheel. A typical specification for total radial runout is 1.14 mm (0.04 in). • **Is the radial runout within specifications?**	**Yes** INSTALL a new tire. TEST the system for normal operation. **No** GO to J7 .
J7 CHECK THE HUB/BRAKE DISC OR DRUM PILOT RUNOUT OR BOLT CIRCLE RUNOUT	
• Measure the pilot or bolt circle runout. A typical specification for radial runout is: ♦ pilot runout less than 0.15 mm (0.006 inch).	**Yes** INSTALL a new wheel. TEST the system for normal operation.

♦ bolt circle runout less than 0.38 mm (0.015 inch). • **Is the radial runout within specifications?**	**No** REPAIR or INSTALL new components as necessary. REFER to Section 204-04 .
J8 LATERAL RUNOUT CHECK ON THE TIRE	
• Measure the lateral runout of the wheel and tire assembly. A typical specification for total lateral runout is 1.14 mm (0.04 in).  A0011804 • **Is the lateral runout within specifications?**	**Yes** Wheel and tires OK. CONDUCT diagnosis on other suspect systems. **No** GO to J9 .
J9 LATERAL RUNOUT CHECK ON THE WHEEL	
• Measure the lateral runout of the wheel. A typical specification for total radial runout is 1.14 mm (0.04 in). • **Is the lateral runout within specifications?**	**Yes** INSTALL a new tire. TEST the system for normal operation. **No** GO to J10 .
J10 CHECK THE FLANGE FACE LATERAL RUNOUT	
• Measure the flange face lateral runout. A typical specification for lateral runout is: ♦ hub/brake disc less than 0.13 mm (0.005 inch). ♦ axle shaft less than 0.25 mm (0.010 inch). • **Is the lateral runout within specifications?**	**Yes** INSTALL a new wheel. TEST the system for normal operation. **No** REPAIR or INSTALL new components as necessary. REFER to Section 204-00 .

PINPOINT TEST K: HIGH SPEED SHAKE OR SHIMMY

Test Step	Result / Action to Take
K1 CHECK FOR FRONT WHEEL BEARING ROUGHNESS	
• Chock the rear wheels. • Raise and support the front end of the vehicle so that the front wheel and tire assemblies can spin. • Spin the front tires by hand. Refer to Wheel Bearing Check in this section. • **Do the wheel bearings feel rough?**	**Yes** INSPECT the wheel bearings. REPAIR as necessary. TEST the system for normal operation. **No** GO to K2 .
K2 CHECK THE END PLAY OF THE FRONT WHEEL BEARINGS	

• Check the end play of the front wheel bearings. Refer to Section 204-00 . • **Is the end play OK?**	**Yes** GO to K3 . **No** ADJUST or REPAIR as necessary. TEST the system for normal operation.
K3 MEASURE THE LATERAL RUNOUT AND THE RADIAL RUNOUT OF THE FRONT WHEELS ON THE VEHICLE	
• Measure the lateral runout and the radial runout of the front wheels on the vehicle. GO to Pinpoint Test J . • **Are the measurements within specifications?**	**Yes** GO to K4 . **No** INSTALL new wheels as necessary and BALANCE the assembly. TEST the system for normal operation.
K4 MEASURE THE LATERAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
• Measure the lateral runout of the front tires on the vehicle. GO to Pinpoint Test J . • **Is the runout within specifications?**	**Yes** GO to K5 . **No** INSTALL new tires as necessary and BALANCE the assembly. TEST the system for normal operation.
K5 MEASURE THE RADIAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
• Measure the radial runout of the front tires on the vehicle. GO to Pinpoint Test J . • **Is the runout within specifications?**	**Yes** BALANCE the front wheel and tire assemblies. If any tire cannot be balanced, INSTALL a new tire. TEST the system for normal operation. **No** GO to K6 .
K6 MATCH MOUNT THE TIRE AND WHEEL ASSEMBLY	
• Mark the high runout location on the tire and also on the wheel. Break the assembly down and rotate the tire 180 degrees (halfway around) on the wheel. Inflate the tire and measure the radial runout. • **Is the runout within specifications?**	**Yes** BALANCE the assembly. TEST the system for normal operation. **No** If the high spot is not within 101.6 mm (4 inches) of the first high spot on the tire, GO to K7 .
K7 MEASURE THE WHEEL FLANGE RUNOUT	
• Dismount the tire and mount the wheel on a wheel balancer. Measure the runout on both wheel flanges. Refer to Section 204-00 .	**Yes** LOCATE and MARK the low spot on the wheel. INSTALL the tire, matching the high spot on the tire with the low spot on the wheel. BALANCE the assembly. TEST the system for normal operation. If

 DG0199-A • **Is the runout within specifications?**	the condition persists,GO to K8 . **No** INSTALL a new wheel. CHECK the runout on the new wheel. If the new wheel is within limits, LOCATE and MARK the low spot. INSTALL the tire, matching the high spot on the tire with the low spot on the wheel. BALANCE the assembly. TEST the system for normal operation. If the condition persists, GO to K8 .
K8 CHECK FOR VIBRATION FROM THE FRONT OF THE VEHICLE	
⚠ WARNING: If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (34 mph) using the speedometer reading, since actual wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage. • Spin the front wheel and tire assemblies with a wheel balancer while the vehicle is raised on a hoist. Feel for vibration in the front fender or while seated in the vehicle. • **Is the vibration present?**	**Yes** SUBSTITUTE known good wheel and tire assemblies as necessary. TEST the system for normal operation. **No** GO to K9 .
K9 CHECK FOR VIBRATION FROM THE REAR OF THE VEHICLE	
⚠ WARNING: If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (34 mph) using the speedometer reading, since actual wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage. • Chock the front wheels. • Raise and support the rear end of the vehicle so that the rear wheel and tire assemblies can spin. • Engage the drivetrain and carefully accelerate the drive wheels while checking for vibration. • **Is the vibration present?**	**Yes** GO to K10 . **No** TEST the system for normal operation.
K10 CHECK THE DRIVETRAIN	
⚠ WARNING: If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (34 mph) using the speedometer reading, since actual	**Yes** CHECK/TEST the drivetrain and driveline components. TEST the system for normal operation.

wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage. • Remove the rear wheel and tire assemblies. Refer to Section 204-00 . • Secure the brake drums (if so equipped), by installing wheel hub bolt nuts, reversed. • Carefully accelerate the drivetrain while checking for vibration. • **Is the vibration present?**	**No** SUBSTITUTE known good wheel and tire assemblies as necessary. TEST the system for normal operation.

Component Tests

Idle Air Control (IAC) Valve

1. Open the hood.

2. **NOTE:** Key symptom is elevated idle speed while noise is occurring.

   NOTE: "Snapping" the throttle can induce the noise.

   Verify the condition by operating the vehicle for a short time.

3. Inspect the IAC valve. If physical evidence of contamination exists, install a new IAC valve.

4. While the noise is occurring, either place an EngineEAR probe near the IAC valve and the inlet tube, or create a 6.35 mm (0.25 in)-12.7 mm (0.50 in) air gap between the inlet tube and the clean air tube. If the IAC valve is making the noise, install a new IAC valve.

5. Test the vehicle for normal operation.

Steering Gear Grunt/Shudder Test

1. Start and run the vehicle to operating temperature.

2. Set engine idle speed to 1200 rpm.

3. ⚠ **CAUTION: Do not hold the steering wheel against the stops for more than three to five seconds at a time. Damage to the power steering pump will occur.**

   Rotate the steering wheel to the RH stop, then turn the steering wheel 90 degrees back from that position. Turn the steering wheel slowly in a 15 degrees to 30 degrees arc.

4. Turn the steering wheel another 90 degrees. Turn the steering wheel slowly in a 15 degrees to 30 degrees arc.

5. Repeat the test with power steering fluid at different temperatures.

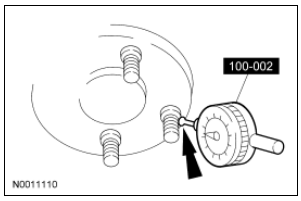
6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition.

7. If a loud grunt is heard or a strong shudder is felt, fill and purge the power steering system.

Wheel Hub Bolt Circle Runout

NOTE: The brake discs must be removed to carry out all runout measurements.

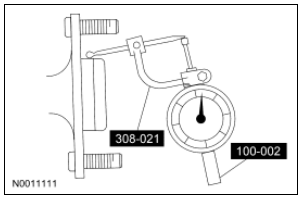
1. Position the special tool on the wheel hub bolt, as close to the hub face as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub until the next bolt is contacted. Record the measurement and continue until each bolt is checked. The difference between the maximum and minimum contact readings will be the total wheel hub bolt circle runout. The runout must not exceed 0.38 mm (0.015 in).

Pilot Runout

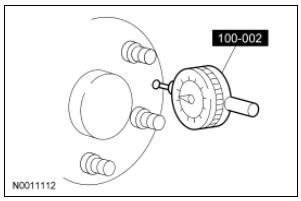
1. Position the special tools on the pilot, as close to the hub as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub one full turn and note the maximum and minimum readings. The difference between the maximum and minimum readings will be the total pilot runout. Pilot runout must not exceed 0.15 mm (0.006 in).

Wheel Hub Runout

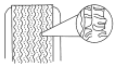
1. Position the special tool on the wheel hub, as close to the outer edge as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub one full turn and note the maximum and minimum readings. The difference between the maximum and minimum readings will be the total wheel hub runout. The runout must not exceed 0.127 mm (0.005 in).

Tire Wear Patterns and Frequency Calculations

Tire Wear Chart

TIRE WEAR	CONDITION	POSSIBLE CAUSES
	•Rapid wear at both shoulders.	•Tires underinflated. •Worn suspension components. •Excessive cornering speeds. •Lack of rotation.
	•Rapid wear at the center.	•Tires overinflated. •Lack of rotation. •Excessive toe on drive wheels. •Heavy acceleration on drive wheels.
	•Wear at one shoulder.	•Toe adjustment out of specification. •Camber out of specification. •Damaged strut. •Damaged lower control arm.
	•Feather edges.	•Toe adjustment out of specification. •Damaged or worn tie rods. •Damaged spindle or knuckle.
	•Bald spots or cupping.	•Unbalanced wheel. •Excessive radial runout. •Worn strut or shock absorber.
	•Tire scalloped.	•Toe adjustment out of specification. •Camber out of specification. •Worn or damaged suspension components.
	•Wear pattern - FWD vehicles.	•Excessive toe on non-drive wheels. •Lack of rotation.
	•Wear pattern - FWD vehicles. Edge of thread blocks worn.	•Excessive toe on non-drive wheels. •Lack of rotation.

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Wheel and tire NVH concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in NEUTRAL is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.

Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Carry out a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions.

For a vibration concern, use the vehicle speed to determine tire/wheel frequency and rpm. Calculate tire and wheel rpm and frequency by carrying out and following:

- Measure the diameter of the tire.
- Record the speed at which the vibration occurs.
- Obtain the corresponding tire and wheel rpm and frequency from the Tire Speed and Frequency Chart.
    - ♦ If the vehicle speed is not listed, divide the vehicle speed at which the vibration occurs by 16 km/h (10 mph). Multiply that number by 16 km/h (10 mph) tire rpm listed for that tire diameter in the chart. Then divide that number by 60. For example: a 40 mph vibration with 835 mm (33 in) tires. 40Ã·10 = 4. Multiply 4 by 105 = 420 rpm. Divide 420 rpm by 60 seconds = 7 Hz at 40 mph.

Tire Speed and Frequency Chart

Tire Diameter	**Tire RPM/Hz**	**Tire RPM/Hz**	**Tire RPM/Hz**	**Tire RPM/Hz**
mm (inch)	@ 16 km/h (10 mph)	@ 80 km/h (50 mph)	@ 97 km/h (60 mph)	@ 113 km/h (70 mph)
483 (19)	182	910/15	1092/18	1274/21
508 (20)	173	865/14	1038/17	1211/20
533 (21)	165	825/14	990/16	1155/19
560 (22)	158	790/13	948/16	1106/18
585 (23)	151	755/13	906/15	1057/18
610 (24)	145	725/12	870/14	1015/17
635 (25)	139	695/12	834/14	973/16
660 (26)	134	670/11	804/13	938/16
685 (27)	129	645/11	774/13	903/15
710 (28)	124	620/10	744/12	868/14
735 (29)	119	595/10	714/12	833/14
760 (30)	115	575/10	690/11	805/13
785 (31)	111	555/9	666/11	777/13
810 (32)	108	540/9	648/11	756/13
835 (33)	105	525/9	630/10	735/12
864 (34)	102	510/8	612/10	714/12

Powertrain/Drivetrain Mount Neutralizing

⚠ **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Loosen, but do not remove, the powertrain/drivetrain mount fasteners.
3. Lower the vehicle.
4. ***NOTICE:*** **Do not twist or strain the powertrain/drivetrain mounts.**

   Move the vehicle in forward and reverse 0.6-1.2 meters (2-4 ft).
5. Raise the vehicle.
6. Tighten the powertrain/drivetrain mount fasteners.
7. Lower the vehicle.
8. Test the system for normal operation.

Exhaust System Neutralizing

⚠ WARNING: Exhaust gases contain carbon monoxide, which is harmful to health and potentially lethal. Repair exhaust system leaks immediately. Never operate the engine in an enclosed area.

⚠ WARNING: Exhaust system components are hot.

NOTE: Neutralize the exhaust system to relieve strain on mounts which can be sufficiently bound up to transmit vibration as if grounded.

1. **⚠ WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.**

   NOTICE: **Make sure the system is warmed up to normal operating temperature, as thermal expansion can be the cause of a strain problem.**

   With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Loosen all exhaust hanger attachments and reposition the hangers until they hang free and straight.

3. Loosen all exhaust flange joints.

4. Place a stand to support the muffler parallel to the vehicle frame with the muffler pipe bracket free of stress.

5. Tighten the muffler connection.

6. Tighten all the exhaust hanger clamps and flanges (tighten the exhaust manifold flange joint last).
   - Verify there is adequate clearance to prevent grounding at any point in the system. Make sure that the catalytic converter and heat shield do not contact the frame rails.
   - After neutralization, the rubber in the exhaust hangers should show some flexibility when movement is applied to the exhaust system.
   - With the exhaust system installed securely and cooled, the rear hanger should be angled forward.

7. Lower the vehicle.

8. Test the exhaust system for normal operation.

Wheel Bearing Check

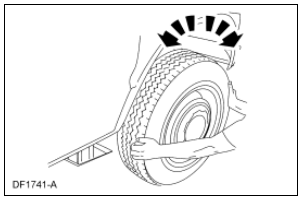
1. ⚠ **WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.**

   Raise the vehicle until the front tires are off the floor.

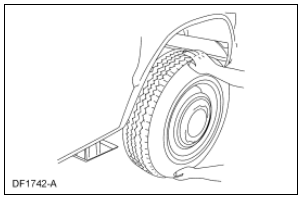
   - Make sure the wheels are in a straight forward position.

2. **NOTE:** Make sure the wheel rotates freely and that the brake pads are retraced sufficiently to allow free movement of the tire and wheel assembly.

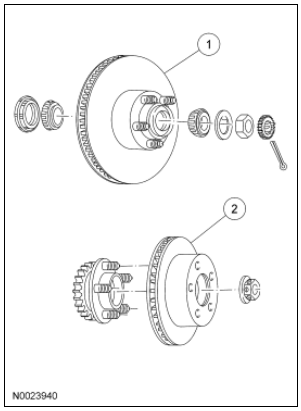
   Spin the tire by hand to check the wheel bearings for roughness.



3. Grip each front tire at the top and bottom and move the wheel inward and outward while lifting the weight of the tire off the front wheel bearing.



4. If the tire and wheel (hub) is loose on the spindle, does not rotate freely, or has a rough feeling when spun, carry out one of the following:
   1. On vehicles with inner and outer bearings, inspect the bearings and cups for wear or damage. Adjust or install new bearings and cups as necessary.
   2. On vehicles with one sealed bearing, install a new wheel hub.



General Specifications

Item	Specification
Lubricants	
Silicone Lubricant (Spray) XL-6	ESR-M13P4-A
Adhesives	
Trim and Weatherstrip Adhesive TA-14	—
Sealers	
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Liquid Butyl Sealer TA-18	ESB-M4G162-A

Body

The uni-body structure is a monocoque, lightweight, all-steel material with removable hood, front fenders, doors and luggage compartment lid.

Body System

Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Inspection and Verification

Leaks

NOTE: Damaged, wet or dusty trim panels will reveal the location of most leaks.

1. Remove any trim or carpet in the general area of the leak.
2. Road test or water test the vehicle.
3. Inspect for a dust pattern around the area in question. Inspect for water paths near and above the area in question.
4. Some leaks can be located by placing a bright light under the vehicle, removing any necessary trim or carpet, and inspecting the interior of the body at joints and weld lines.

Noise

Wind noise, rattles and their sources are detected by driving the vehicle at highway speeds. The vehicle should be driven in four different directions with all of the windows closed, the audio unit off, the blower motor off, and all of the ventilation ducts open.

Most wind noise leaks will occur at the door and window seals or at the sheet metal joints in the door or the door opening.

Symptom Chart

Symptom Chart

Torque Specifications

Description	Nm	lb-ft	lb-in
Windshield wiper pivot arm nuts	25	—	18
Front fender bolts	9	80	—
Radiator grille opening panel bolts	11	—	9
Headlamp assembly bolts	6	53	—
Hood striker bolts	12	9	—

Front End Body Panels

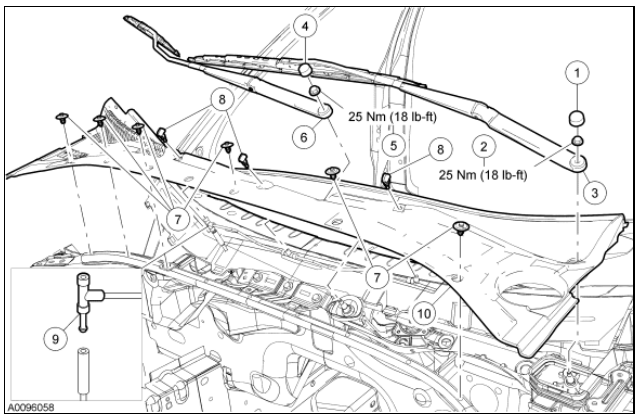
Front End Body Panels

The grille opening reinforcement:

- is bolted to the fenders and bumper beam.
- retains the headlamp assemblies and bumper cover.

The cowl vent screen is a 2-piece component. The right side of the cowl vent screen may be removed without the removal of the windshield wiper pivot arm.

Cowl Panel Grille



Item	Part Number	Description
1	17D515	Windshield wiper pivot arm nut cover
2	—	Windshield wiper pivot arm nut
3	17527	Windshield wiper pivot arm
4	17D515	Windshield wiper pivot arm nut cover
5	—	Windshield wiper pivot arm nut
6	17526	Windshield wiper pivot arm
7	W705956	Pin-type retainers (6 required)
8	54018A14-A	Windshield washer jets
9	17K605-A	Windshield washer hose
10	018A14	Cowl panel grille

Removal

1. Remove the 2 covers, 2 nuts, and the 2 windshield wiper pivot arms.

2. Remove the 6 pin-type retainers and separate the cowl panel grille.
   - Lift up on the cowl panel grille to release the clips.

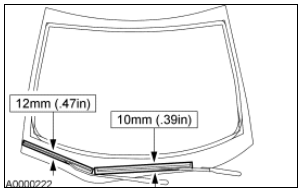
Installation

1. **NOTE:** Use the lower rearward clips as locators prior to installation, working from the center of the vehicle outward.

   Position the cowl panel grille and install the 6 pin-type retainers.

2. **NOTE:** Do not tighten the wiper pivot arm nuts until the windshield wiper pivot arms are properly adjusted to specification.

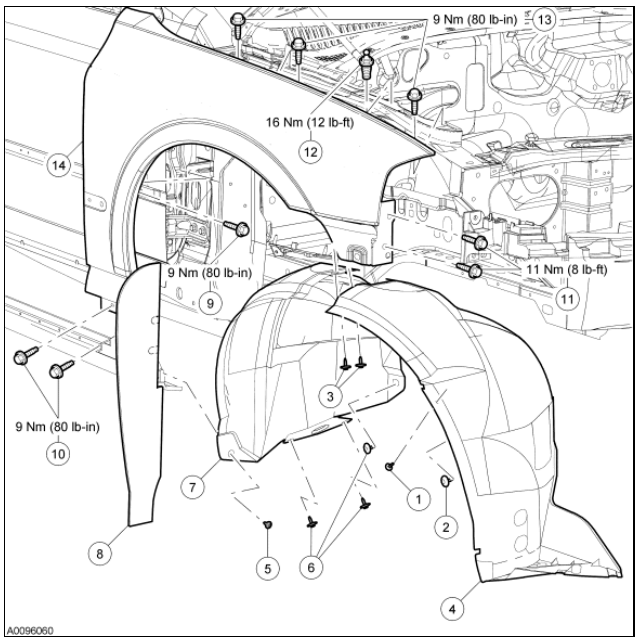
   Install the 2 windshield wiper and pivot arms onto the pivot shafts, install the 2 nuts, and align the blade to the heated wiper park/windshield wire lines on the windshield glass within the specification.



3. Cycle the windshield wiper motor to park the windshield wiper pivot arm shafts.

4. Tighten the 2 windshield wiper pivot arm nuts.
   - Tighten to 25 Nm (18 lb-ft) and install the 2 wiper pivot arm nut covers.

Front End Body Panels — Exploded View



Item	Part Number	Description
1	N801169-S	Screw
2	N802781	Pin-type retainer
3	388930	Pin-type retainers
4	16034/16035	Front fender front splash shield
5	56913-S	Screw
6	N802781	Pin-type retainers
7	16B568/16B569	Front fender rear splash shield
8	16E560/16E561	Fender insulator
9	—	Inner front fender bolt
10	—	Lower front fender bolts (2 required)
11	—	Radiator grille opening panel bolt (2 required)
12	—	Hood assist strut ball stud
13	—	Front fender top bolts (3 required)
14	16005/16006	Fender

1. For additional information, refer to the procedures in this section.

Fender Splash Shield

Removal and Installation

1. Remove the 3 pin-type retainers and the front fender front splash shield.
2. Remove the front fender rear splash shield screw.
3. Remove the 3 pin-type retainers and the front fender rear splash shield.
4. To install, reverse the removal procedure.

Fender

Removal and Installation

1. Remove the front and rear fender splash shields. For additional information, refer to Fender Splash Shield in this section.

2. Remove the bumper cover. For additional information, refer to Section 501-19 .

3. Remove the 2 front pin-type retainers and position the front rocker moulding aside.

4. Remove the 4 pin-type retainers and the radiator upper sight shield.

5. Remove the 3 bolts and the headlamp assembly.
   - Disconnect the electrical connector.
     - To Install, tighten to 6 Nm (53 lb-in).
     - If necessary, adjust the headlamp. For additional information, refer to Section 417-01 .

6. Remove the 2 radiator grille opening panel bolts.
   - To install, tighten to 11 Nm (8 lb-in).

7. Disengage the wiring harness locator.

8. **NOTE:** Support the hood using a prop rod.

   Disengage the lower hood assist strut.

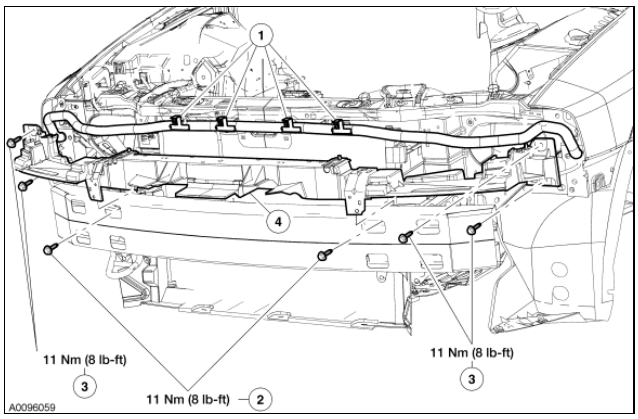
9. Remove the hood assist strut ball stud.
   - To install, tighten to 16 Nm (12 lb-ft)

10. Remove the 2 lower front fender bolts.
    - To install, tighten to 9 Nm (80 lb-in).

11. Remove the 3 upper front fender bolts and remove the fender.
    - To install, tighten to 9 Nm (80 lb-in).

12. To install, reverse the removal procedure.
    - Adjust the fender as needed.

Radiator Grille Opening Panel



Item	Part Number	Description
1	N801169-S	Wiring harness locators
2	N802781	Radiator grille opening panel bolts (2 required)
3	388930	Radiator grille opening panel bolts (4 required)
4	16034/16035	Radiator grille opening panel

Removal and Installation

1. Remove the front bumper cover. For additional information, refer to Section 501-19 .

2. Remove the 4 pin-type retainers and the radiator upper sight shield.

3. Remove the 6 bolts and the headlamp assemblies.
   - Disconnect the electrical connectors.
     - To install, tighten to 6 Nm (53 lb-in).
     - If necessary, adjust the headlamps. For additional information, refer to Section 417-01 .

4. Release the wiring harness fasteners and position the wiring harnesses rearward.

5. Release the ambient air temperature sensor.

6. Remove the 6 bolts, the brackets, and the radiator grille opening panel.
   - To install, tighten to 11 Nm (8 lb-ft).

7. To install, reverse the removal procedure.

General Specifications

Item	Specification
Body Closures	
Door clearance front and rear	3.0 - 7.0 mm (0.118 - 0.275 in.) parallel top to bottom within 1.0 mm (0.04 in)
Top of door to roof clearance	2.5 - 7.5 mm (0.098 - 0.295 in.) parallel front to back

Torque Specifications

Description	Nm	lb-ft
Door check arm nuts	12	9
Door check arm screws	12	9
Door latch striker bolts	40	30
Door latch striker plate bolts	25	18
Hinge-to-body bolts	30	22
Hinge-to-door bolts	30	22
Hinge-to-luggage compartment lid bolts	12	9
Inner front door support bracket nuts and bolt	12	9

Door Alignment

Front and rear door

1. Loosen the door latch striker bolts.

Front door horizontal and vertical adjustment

2. Loosen the front door hinge-to-door bolts.

3. Adjust the front door.

4. Tighten the front door hinge-to-door bolts.
   - Tighten to 30 Nm (22 lb-ft).

Front door fore and aft adjustment

5. Remove the fender splash shield. For additional information, refer to Section 501-02 .

6. Remove the fender insulator panel.

7. Loosen the door hinge-to-body bolts.

8. Adjust the front door.

9. Tighten the front door hinge-to-body bolts.
   - Tighten to 30 Nm (22 lb-ft).

Rear door horizontal and vertical adjustment

10. Loosen the rear door hinge-to-door bolts.

11. Adjust the rear door.

12. Tighten the rear door hinge-to-door bolts.
    - Tighten to 30 Nm (22 lb-ft).

Rear door fore and aft adjustment

13. Loosen the rear door hinge-to-body bolts.

14. Adjust the rear door.

15. Tighten the rear door hinge-to-body bolts.
    - Tighten to 30 Nm (22 lb-ft).

Front and rear door

16. Tighten the door latch striker bolts.
    - Tighten to 40 Nm (30 lb-ft).

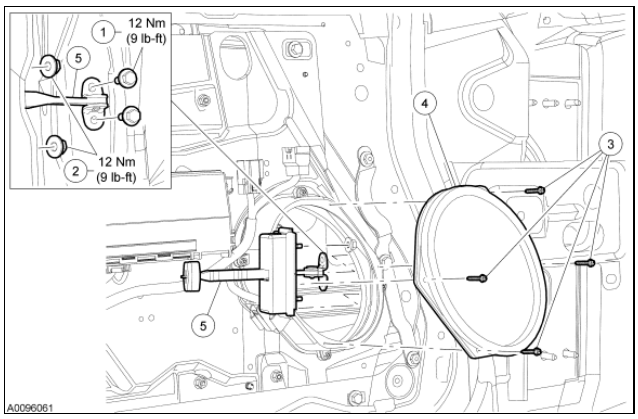
Door Striker Adjustment

1. Loosen the door latch striker plate bolts.

2. Adjust the door latch striker plate as necessary.

3. Tighten the door latch striker plate bolts.
   - Tighten to 25 Nm (18 lb-ft).

Door Check Arm



Item	Part Number	Description
1	W707426	Door check arm screws (2 required)
2	W704723	Door check arm nuts (2 required)
3	W701930	Speaker screws (4 required)
4	18808A	Speaker
5	23553	Door check arm

Removal and Installation

1. Remove the door trim panel. For additional information, refer to Section 501-05 .

2. ⚠ **CAUTION: Do not close the door after removal of the check arm screws.**

   Remove the 2 door check arm screws.

   - To install, tighten to 12 Nm (9 lb-ft).

3. Remove the 4 screws and the speaker.
   - Disconnect the electrical connector.

4. Remove the nuts and the door check arm.
   - To install, tighten to 12 Nm (9 lb-ft).

5. To install, reverse the removal procedure.

General Specifications

Item	Specification
Adhesives	
Headliner Adhesive (commercially available)	WSS-M2G355-B

Torque Specifications

Description	Nm	lb-ft
Front seat safety belt nut	40	30
Rear safety belt anchor bolt	40	30

Interior Trim

Interior Trim

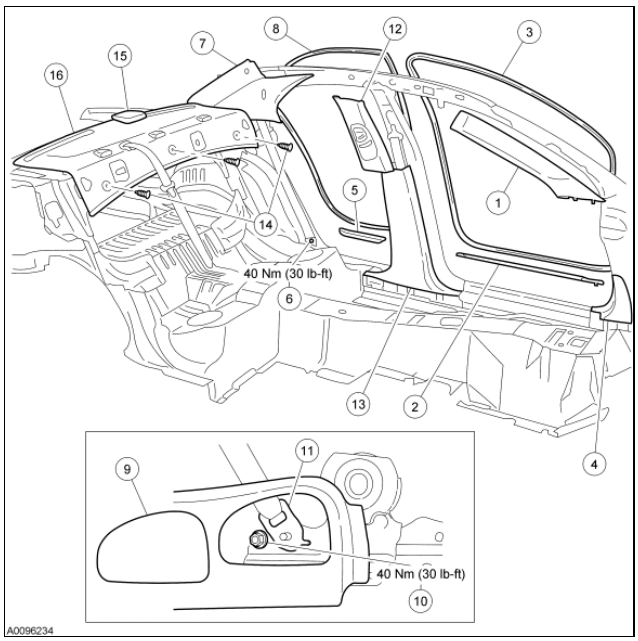
The interior trim consists of:

- door trim panels
- headliner
- package tray
- rear quarter trim panels
- sun visors
- tether anchor covers
- upper quarter trim panel
- scuff plates
- A-pillar trim panels
- A-pillar lower trim panels

Interior Trim

The interior trim panels provide insulation from noise and exterior temperatures. They cover the interior of the vehicle sheet metal, covering the many modules, latches, handles, cables and wiring. They also provide a mounting location for the window control and door lock switches.

Interior Trim — Exploded View



Item	Part Number	Description
1	03598	A-pillar trim panel
2	13208	Front door scuff plate
3	20709	Front door weatherstrip
4	02345	A-pillar lower trim panel
5	13228	Rear door scuff plate
6	W700883	Rear safety belt anchor bolt
7	5452018/ 5452019	Quarter trim panel (LH/RH)
8	253A10	Rear door weatherstrip
9	—	Front seat safety belt anchor cover
10	N800937	Front seat safety belt nut
11	M7H57	Front seat safety belt
12	24356	Upper B-pillar trim panel
13	24346	Lower B-pillar trim panel
14	391039	Parcel shelf pin-type retainer
15	611C04	Rear center safety belt cover
16	4998	Parcel shelf trim panel

1. For additional information, refer to the procedures in this section.

B-Pillar Trim Panel

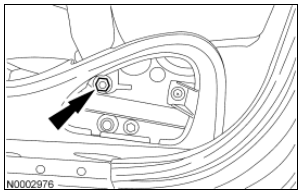
Removal and Installation

NOTE: If the supplemental restraint system (side air curtains) has deployed, check the B-pillar trim panel for damage.

1. Pull back the weatherstrips surrounding the B-pillar trim panels.

2. Remove the front seat safety belt anchor cover.

3. Remove the front seat safety belt nut.
   - To install, tighten to 40 Nm (30 lb-ft).



4. Remove the front and rear scuff plates.

5. Remove the upper and lower B-pillar trim panels.

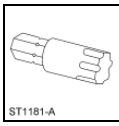
6. **NOTE:** Position the shoulder safety belt height adjuster at its highest setting before installing the upper B-pillar trim panel.

   To install, reverse the removal procedure.

   - Check the restraint system for correct operation.

Quarter Trim Panel

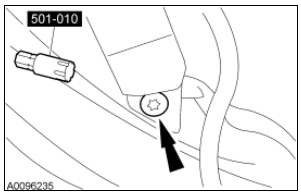
Special Tool(s)

 ST1181-A	Torx Bit, Safety Belt Bolt 501-010 (T77L-2100-A)

Removal and Installation

1. Remove the rear seat bolster. For additional information, refer to Section Section 501-10 .

2. Using the special tool, remove the rear safety belt anchor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).



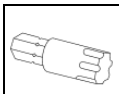
3. **NOTE:** Position the weatherstrip over the rear quarter trim panel.

   Remove the rear quarter trim panel.

4. To install, reverse the removal procedure.
   - Check the restraint system for correct operation.

Parcel Shelf

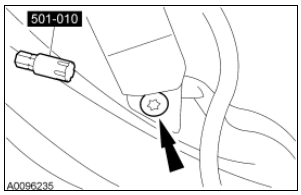
Special Tool(s)

 ST1181-A	Torx Bit, Safety Belt Bolt 501-010 (T77L-2100-A)

Removal and Installation

1. Remove the rear seat bolsters. For additional information, refer to Section 501-10 .

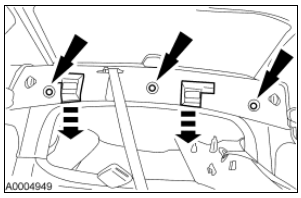
2. Using the special tool, remove the RH and LH rear safety belt anchor bolts.
   - To install, tighten to 40 Nm (30 lb-ft).



3. Position the weatherstrips aside, and remove the 2 rear quarter trim panels.

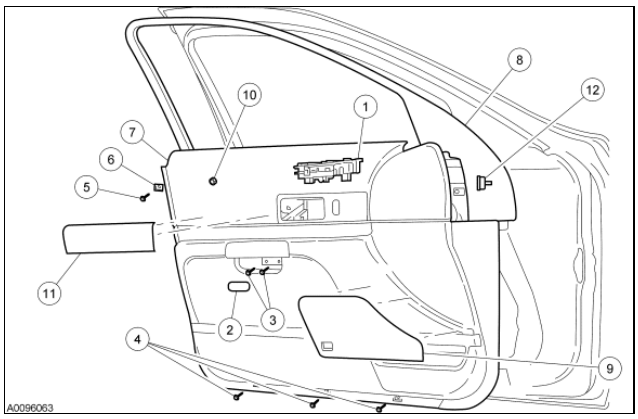
4. Remove the rear center safety belt cover.

5. Remove the 3 pin-type retainers, pull down the rear seat latch covers and remove the parcel shelf trim panel.



6. To install, reverse the removal procedure.

Door Trim Panel — Front



Item	Part Number	Description
1	14528A	Window regulator control switch panel assembly
2	22670	Door trim panel handle screw cover
3	S5929	Door trim panel handle screws (2 required)
4	N806555	Door trim panel screws (3 required)
5	S5929	Door trim panel screw
6	67841	Screw grommet
7	23942/23943	Front door trim panel (LH/RH)
8	20890/20891	Front door window garnish moulding (LH/RH)
9	601B48/601B49	Speaker grille (LH/RH)
10	—	Door trim panel applique nut
11	20942/20943	Door trim panel applique (LH/RH)
12	2W4254	Door trim panel pin-type retainers (9 required)

Removal and Installation

1. Disconnect the battery. For additional information, refer to Section 414-01 .

2. Remove the window regulator control switch panel assembly. For additional information, refer to Section 501-11 .
   - Insert a small trim tool to release the front retainer of the window control switch bezel.
   - Disconnect the electrical connectors.

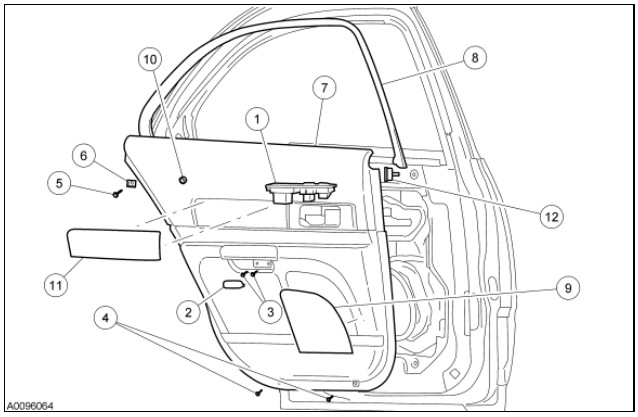
3. **NOTE:** Using a thin-blade screwdriver, insert the screwdriver 2-3Â mm (0.78-0.118Â in) and rotate to disengage the snap feature of the door trim panel handle screw cover.

   Remove the door trim panel handle screw cover, and the 2 door trim panel handle screws.

4. Remove the 4 door trim panel screws and the front door trim panel.

5. To install, reverse the removal procedure.

Door Trim Panel — Rear



Item	Part Number	Description
1	14528B	Window regulator control switch panel assembly
2	22670	Door trim panel handle screw cover
3	56914	Door trim panel handle screws (2 required)
4	N806555	Door trim panel screws (2 required)
5	W504246	Door trim panel screw
6	239A04	Screw grommet
7	23942/23943	Rear door trim panel (LH/RH)
8	20890/20891	Rear door window garnish moulding (LH/RH)
9	601B48/601B49	Speaker grille (LH/RH)
10	—	Door trim panel applique nuts
11	20942/20943	Door trim panel applique (LH/RH)
12	W708599	Door trim panel pin-type retainers (9 required)

Removal and Installation

1. Disconnect the battery. For additional information, refer to Section 414-01 .

2. Remove the window regulator control switch panel.
   - Disconnect the electrical connectors.

3. **NOTE:** Using a suitable tool, insert 2-3Â mm (0.78-0.118Â in) and rotate to disengage the snap feature.

   Remove the door trim panel handle screw cover and remove the 2 screws.

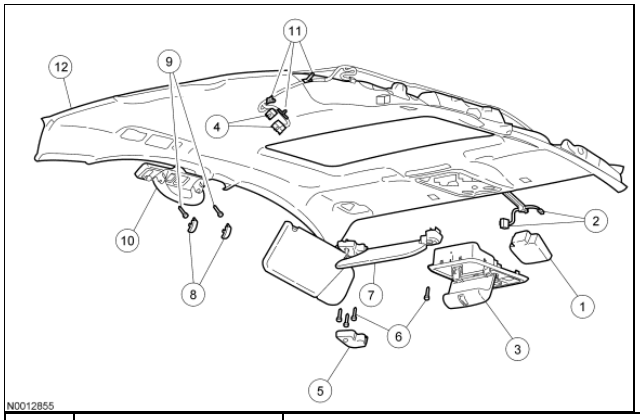
4. Remove the 3 screws and remove the rear door trim panel.

5. To install, reverse the removal procedure.

Headliner

Material

Item	Specification
Headliner Adhesive (commercially available)	WSS-M2G355-B



Item	Part Number	Description
1	17D550	Rain sensor cover
2	23942	Interior mirror and rain sensor module electrical connectors (if equipped)
3	23A742	Overhead console
4	56914	Headliner electrical connector
5	N806555	Sun visor screw cover
6	W504443	Sun visor screws (6 required)
7	239A04	Sun visor
8	23942/23943	Passenger assist handle screw covers (6 required) (LH/RH)
9	W504443	Passenger assist handle screws (6 required) (LH/RH)
10	31406A	Passenger assist handles
11	238A70/238A71	Headliner wiring harness locators (LH/RH)
12	51916	Headliner

Removal

1. Remove driver and passenger front seats. For additional information, refer to Section 501-10 .
2. Disconnect the interior rear view mirror electrical connector.
3. If equipped, remove the rain sensor cover and disconnect the electrical connector.
4. Remove the 6 screws and the sun visors.
    - Disconnect the electrical connectors.

5. Remove the 2 screws and the sun visor clips.

6. If equipped, remove the 3 passenger assist handles.
   - Position the 6 screw covers aside.
   - Remove the 6 screws.
   - If equipped, disconnect the electrical connector.

7. Remove the 2 A-pillar trim panels.

8. Position the upper portion of the door weatherstrip seals aside.

9. Position the 2 upper B-pillar trim panels aside.

10. Position the 2 quarter trim panels aside.

11. ⚠ **CAUTION: Folding the headliner will result in damage to the headliner.**

    NOTE: For vehicles without a roof opening panel, use a plastic scraper to detach the headliner from the roof.

    Release the map lamp clips and lower the headliner.

12. Disconnect the electrical connectors.

13. Remove the headliner from the left rear door opening.

Installation

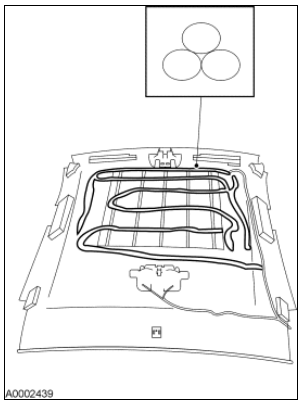
Installing a new headliner

1. ⚠ **CAUTION: Folding the headliner will result in damage to the headliner.**

   Carefully position the headliner in the vehicle.

2. **NOTE:** Adhesive is required for vehicles without a roof opening panel. Adhesive must be applied in two parallel beads with a third bead applied on top to ensure proper contact and adhesion.

   Apply 3 beads of headliner adhesive to the headliner following the existing pattern.



3. Connect the electrical connectors.

4. Install the headliner.

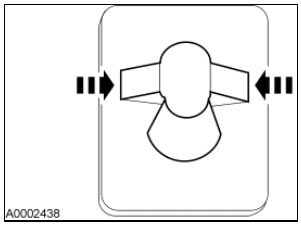
- Press the headliner against the roof to make sure the adhesive contacts both surfaces.

Installing an existing headliner

5. ⚠ **CAUTION: Folding the headliner will result in damage to the headliner.**

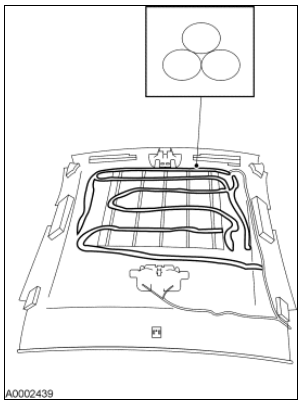
   Carefully position the headliner in the vehicle.

6. Bend the tabs of the rear locator back into their original position.



7. **NOTE:** Adhesive is required for vehicles without a roof opening panel. Adhesive must be applied in two parallel beads with a third bead applied on top to ensure proper contact and adhesion.

   Apply 3 beads of headliner adhesive to the headliner following the existing pattern.



8. Connect the electrical connectors.

9. Install the headliner.
   - Press the headliner against the roof to make sure the adhesive contacts both surfaces.

New or existing headliner

10. Install the quarter trim panels.

11. Install the 2 upper B-pillar trim panels.

12. Install the 2 A-pillar trim panels.

13. Position the sun visor clips and install the 2 screws.

14. Connect the electrical connectors, position the sun visors, and install the 6 screws.

15. If equipped, position the 3 assist handles and install the 6 screws.
    - If equipped, connect the electrical connector.
    - Install the 6 screw covers.

16. Install the door weatherstrips.
17. If equipped, connect the rain sensor electrical connector and install the cover.
18. Connect the interior rear view mirror electrical connector.
19. Install driver and passenger front seats. For additional information, refer to Section 501-10 .

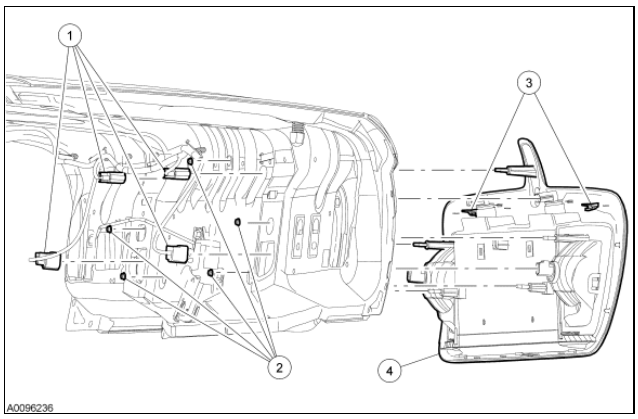
Exterior Trim

Exterior trim

The exterior trim consists of the following components:

- license plate housing
- front door moulding
- rear door moulding
- rocker panel moulding

License Plate Housing



Item	Part Number	Description
1	03598	Electrical connectors
2	13208	License plate housing nuts (5 required)
3	20709	Retaining tabs
4	02345	License plate housing

Removal and Installation

1. Remove the pin-type retainers and the luggage compartment lid trim panel.

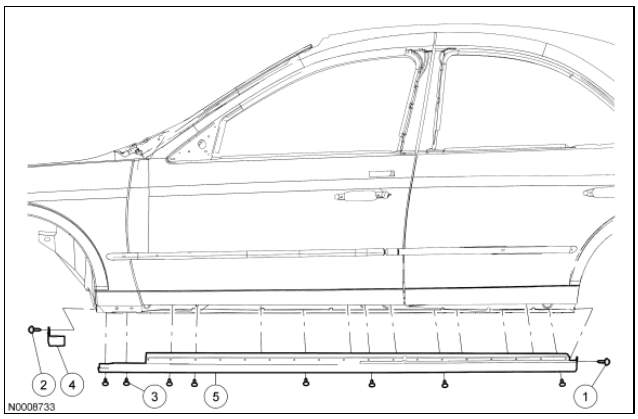
2. Disconnect the license plate lamp electrical connectors.

3. Disconnect the reversing lamp electrical connectors.

4. Remove the 5 license plate housing nuts and release the 2 retaining tabs.
   - Remove the license plate housing.

5. To install, reverse the removal procedure.
   - Transfer components as necessary.

Rocker Panel Moulding



Item	Part Number	Description
1	—	Rocker panel moulding screw
2	—	Rocker panel moulding screw
3	—	Pin-type retainers (8 required)
4	—	Rocker panel moulding end cap
5	10154/10155	Rocker panel moulding (2 required)

Removal and Installation

1. Remove the 2 rocker panel moulding screws.

2. Remove the rocker panel moulding end cap.

3. Remove the 8 pin-type retainers and the rocker panel moulding.

4. To install, reverse the removal procedure.
    - Discard the retaining cups and install new cups during installation.

General Specifications

Item	Specification
Rear View Mirror Adhesive TA-17	—

Torque Specifications

Description	Nm	lb-ft	lb-in
Exterior mirror nuts	5	—	44

Rear View Mirrors

The rear view mirrors consist of the following components:

- heated exterior mirrors (with memory, if equipped)
- exterior mirror control switch
- auto-dimming interior rear view mirror

Rear View Mirrors

Refer to Wiring Diagrams Cell 124 for schematic and connector information.

Refer to Wiring Diagrams Cell 125 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Principles of Operation

The exterior mirrors are electrically controlled by the exterior mirror control switch for both vertical and horizontal movement. The exterior mirror control switch is hardwired to the driver door module (DDM). When the LH exterior mirror is selected, adjustment is carried out by moving the control switch to the desired position. The DDM receives the adjustment command from the exterior mirror control switch and supplies voltage and ground to the appropriate LH exterior mirror motor to adjust the LH exterior mirror. The RH exterior mirror is controlled by the front electronic module (FEM). When the DDM receives an adjustment command for the RH exterior mirror from the exterior mirror control switch, the DDM interprets the command and sends the adjustment command over the standard corporate protocol (SCP) communication network to the FEM. The FEM interprets the command and supplies voltage and ground to the appropriate RH exterior mirror motor to adjust the RH exterior mirror.

Memory (if equipped)

The memory mirror function recalls the preferred positioning of the exterior mirrors. Memory is activated by the door-mounted switches, the remote keyless entry (RKE) transmitter or the RKE keypad. The DDM and FEM constantly track the exterior mirror position using the potentiometers in the exterior mirror assembly. The positions remain in memory as long as the module retains power. When a memory position is recalled by the operator, the DDM and the FEM power the exterior mirror motors simultaneously and monitor the potentiometer circuits. When the stored memory position is reached, the DDM and FEM remove power from the motors. If the exterior mirror control switch is operated during a memory recall, the modules stop the recall and respond to the exterior mirror control switch command.

Heated Exterior Mirrors

The heated mirror function provides electric heating to both the LH and RH exterior mirrors, which raises the temperature of the glass to clear frost and condensation. The heated exterior mirrors are activated when the heated rear window is in operation, and automatically shut off after 15 minutes. The heated mirror power is supplied by the heated rear window relay through a separate battery junction box (BJB) fuse that isolates the heated mirrors from the heated rear window in the event of a concern with one of the systems.

Auto-Dimming Rear View Mirrors

This feature reduces glare caused by headlamps reflecting in the interior rear view mirror or LH exterior mirror. There are 2 integral sensors to control the dimming function. This feature is switched off by pressing the MODE switch on the interior rear view mirror to the OFF position. The auto-dimming interior rear view mirror defaults to the normal setting when the transmission is placed in REVERSE. The rear electronic module (REM) receives a reverse input from the powertrain control module (PCM) over the SCP communication link, then supplies a power signal to the interior mirror, causing the mirrors to cancel any dimming function. When the transmission is moved out of REVERSE, the auto-dimming mirrors return to normal operation and resume any interrupted dimming function.

If the REM does not receive the reverse input from the PCM, a communication diagnostic trouble code (DTC) is logged. As a default, the REM supplies power to the dimming circuit to prevent the automatic dimming function from operating until the communication is restored.

The transmission reverse information has a time delay before the message is sent by the PCM to the REM. This delay allows for the transmission selector to be moved through REVERSE without canceling the dimming operation.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Exterior mirror(s) • Interior auto-dimming rear view mirror	• Battery junction box (BJB) fuses: ♦ 5 (10A) ♦ 9 (5A) ♦ 20 (30A) • Central junction box (CJB) fuses: ♦ 7 (5A) ♦ 12 (5A) ♦ 30 (5A) • Switched system power (SSP) relays 1 and 2 • Exterior mirror control switch • Exterior mirrors • Interior auto-dimming mirror • Rear electronic module (REM) • Front electronic module (FEM) • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP, ISO, UBP or CAN circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for FEM, refer to Section 419-10 .
    - No response/not equipped for REM, refer to Section 419-10 .
    - No response/not equipped for driver door module (DDM), refer to Section 419-10 .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM, REM and the DDM.

7. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index, Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index, or Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index.

8. If the DTCs retrieved are not found in the following Front Electronic Module (FEM), Rear Electronic Module (REM) or Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Indexes, refer to the Front Electronic Module (FEM), Rear Electronic Module (REM) or Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Indexes in Section 419-10 .

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Is Defective	FEM	CLEAR the DTC. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	GO to Pinpoint Test E .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	GO to Pinpoint Test E .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
All Other DTCs	—	FEM	REFER to Section 419-10 .

Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Is Defective	REM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation.
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
All Other DTCs	—	REM	REFER to Section 419-10 .

Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Is Defective	DDM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new DDM. REFER to Section 419-10 . TEST the system for normal operation.
B1530	Memory Set Switch Circuit Short to Ground	DDM	GO to Pinpoint Test D .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	GO to Pinpoint Test D .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	GO to Pinpoint Test D .
B1676	Battery Pack Voltage Out of Range	DDM	REFER to Section 414-00 .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	GO to Pinpoint Test E .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	GO to Pinpoint Test E .
B2336	Mirror Switch Assembly Circuit Failure	DDM	GO to Pinpoint Test A .
B2477	Module Configuration Failure	DDM	REFER to Section 418-01 .
All Other DTCs	—	DDM	REFER to Section 419-10 .

NOTE: When diagnosing a relay, check that all systems for that relay are inoperative. Refer to Section 417-01 .

Switched System Power (SSP) Index

Relay	Fuse	Controlled System(s)
SSP1	BJB Fuse 27 (30A)	• Driver power door lock (FEM) • LH high beam headlamps (FEM) • RH front park/turn/side marker lamps (FEM) • RH low beam headlamp • Driver exterior mirror • LH front park/turn/side marker lamps (FEM)
SSP2	BJB Fuse 32 (30A)	• LH low beam headlamp (FEM) • RH high beam headlamp (FEM) • Passenger exterior mirror (FEM) • Switch illumination backlighting
SSP3	BJB Fuse 24 (30A)	• High mounted stoplamp (REM) • RH rear park/stoplamps (REM) • Reversing lamps (REM) • LH rear turn signals (REM) • Interior courtesy and demand lighting (FEM)
SSP4	BJB Fuse 23 (30A)	• LH rear park/stoplamps (REM) • RH rear turn signals (REM) • All passenger door locks (REM) • License lamps • Luggage compartment release solenoid/switch • Fuel door release solenoid/switch • Luggage compartment lamp

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Mirrors Are Inoperative

Normal Operation

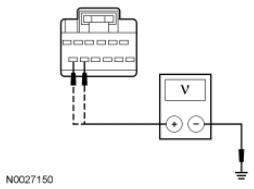
The drivers door module (DDM) receives voltage from the central junction box (CJB) through circuit 29-AJ80 (OG), and circuit 29S-AJ86 (OG/BU). The exterior mirror control switch receives voltage from the CJB through circuit 29-AD12 (OG/YE) and ground from circuit 31-AD12 (BK/YE). The exterior mirror control switch sends input to the DDM for the LH exterior mirror by switching voltage and ground to circuits 32-AD32 (WH/RD), 34-AD31 (BU/WH) and 33-AD12 (YE), and for the RH exterior mirror by switching voltage and ground to circuits 32-AD30 (WH/BK), 34-AD29 (BU/OG) and 33-AD12 (YE). The DDM then

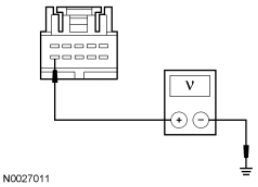
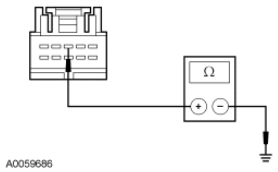
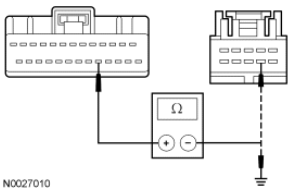
sends the appropriate voltage and ground for the LH exterior mirror motor up/down circuits 34-AD8 (BU/WH), 35-AD8 (VT) and left/right circuits 32-AD7 (WH/RD) and 33-AD7 (YE/RD). The DDM sends a message to the front electronic module (FEM) over the SCP communication link for the FEM to send the appropriate voltage and ground for the RH exterior mirror motor up/down circuits 34-AD11 (BU/OG), 35-AD11 (VT/WH) and left/right circuits 32-AD10 (WH/BK), 33-AD10 (YE/BK).

Possible Causes

- fuse
- circuit 29-AD12 (OG/YE) open
- circuit 29-AJ80 (OG) open
- circuit 29S-AJ86 (OG/BU) open
- circuit 31-AD12 (BK/YE) open
- circuit 33-AD12 (YE) open or short to ground
- exterior mirror control switch
- exterior mirrors
- DDM

PINPOINT TEST A: THE MIRRORS ARE INOPERATIVE

Test Step	Result / Action to Take
A1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND DDM SELF-TESTS	
• Check for DDM DTCs from the continuous and on-demand self-tests. • **Is DTC B2336 recorded?**	**Yes** GO to A6 . **No** GO to A2 .
A2 CHECK CIRCUIT 29-AJ80 (OG), AND CIRCUIT 29S-AJ86 (OG/BU) FOR VOLTAGE	
• Ignition OFF. • Disconnect: DDM C501a. • Ignition ON. • Measure the voltage between the DDM, harness side and ground as follows: **DDM Connector-Pin** / **Circuit** C501a-11 / 29-AJ80 (OG) C501a-12 / 29S-AJ86 (OG/BU)  	**Yes** GO to A3 . **No** VERIFY the central junction box (CJB) fuse 7 (5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

• **Is the voltage greater than 10 volts?**	
A3 CHECK CIRCUIT 29-AD12 (OG/YE) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Exterior Rear View Mirror Switch C527. • Measure the voltage between the exterior rear view mirror switch C527-10, circuit 29-AD12 (OG/YE), harness side and ground.  N0027011 • **Is the voltage greater than 10 volts?**	**Yes** GO to A4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A4 CHECK CIRCUIT 31-AD12 (BK/YE) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the exterior mirror control switch C527-3, circuit 31-AD12 (BK/YE), harness side and ground.  A0059686 • **Is the resistance less than 5 ohms?**	**Yes** GO to A5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A5 CHECK CIRCUIT 33-AD12 (YE) FOR AN OPEN OR A SHORT TO GROUND	
• Measure the resistance between the DDM C501d-18, circuit 33-AD12 (YE), harness side and the exterior mirror control switch C527-7, circuit 33-AD12 (YE), harness side; and between the DDM C501d-18, circuit 33-AD12 (YE), harness side and ground.  N0027010 • **Is the resistance less than 5 ohms between the DDM and the exterior mirror control switch, and greater than 10,000 ohms between the DDM and ground?**	**Yes** GO to A6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

A6 CHECK THE EXTERIOR MIRROR CONTROL SWITCH	
• Carry out the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the exterior mirror control switch pass the component test?**	**Yes** GO to A7 . **No** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.
A7 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all DDM connectors and make sure they seat correctly.
• Operate the system and verify if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 418-00 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: A Single Mirror Is Inoperative

Normal Operation

The exterior mirror control switch sends input to the driver door module (DDM) for the LH exterior mirror by switching voltage and ground to circuits 32-AD32 (WH/RD), 34-AD31 (BU/WH) and 33-AD12 (YE) and for the RH exterior mirror by switching voltage and ground to circuits 32-AD30 (WH/BK), 34-AD29 (BU/OG) and 33-AD12 (YE). The DDM then sends the appropriate voltage and ground for the LH exterior mirror motor up/down circuits 34-AD8 (BU/WH), 35-AD8 (VT) and left/right circuits 32-AD7 (WH/RD) and 33-AD7 (YE/RD). The DDM sends a message to the front electronic module (FEM) over the communication network for the FEM to send the appropriate voltage and ground for the RH exterior mirror motor up/down circuits 34-AD11 (BU/OG), 35-AD11 (VT/WH) and left/right circuits 32-AD10 (WH/BK), 33-AD10 (YE/BK).

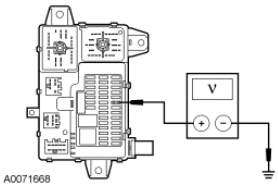
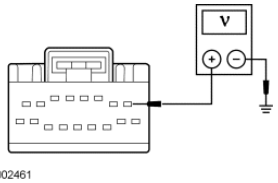
Possible Causes

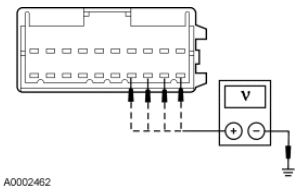
- fuse
- circuit 7-AD18 (YE/BK) open, short to ground, or short to voltage
- circuit 7-AD19 (YE/RD) open, short to ground, or short to voltage
- circuit 8-AD18 (WH/BK) open, short to ground, or short to voltage
- circuit 8-AD19 (WH/RD) open, short to ground, or short to voltage
- circuit 9-AD18 (BN/YE) open, short to ground, or short to voltage
- circuit 9-AD19 (BN/RD) open, short to ground, or short to voltage
- circuit 10-AD18 (GY/BK) open, short to ground,or short to voltage
- circuit 10-AD19 (GY/RD) open, short to ground, or short to voltage
- circuit 29S-AJ86 open
- circuit 29S-DK21 (OG/WH) open or short to ground
- circuit 32-AD7 (WH/RD) open or short to ground
- circuit 32-AD10 (WH/BK) open or short to ground
- circuit 32-AD30 (WH/BK) open

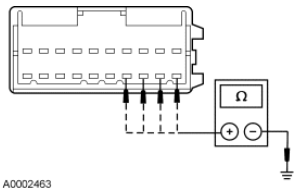
- circuit 32-AD32 (WH/RD) open
- circuit 33-AD7 (YE/RD) open or short to ground
- circuit 33-AD10 (YE/BK) open or short to ground
- circuit 33-AD12 (YE) open
- circuit 34-AD8 (BU/WH) open or short to ground
- circuit 34-AD11 (BU/OG) open or short to ground
- circuit 34-AD29 (BU/OG) open
- circuit 34-AD31 (BU/WH) open
- circuit 35-AD8 (VT) open or short to ground
- circuit 35-AD11 (VT/WH) open or short to ground
- exterior mirror control switch
- FEM
- DDM
- exterior mirror motor

PINPOINT TEST B: A SINGLE MIRROR IS INOPERATIVE

Test Step	Result / Action to Take
B1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND DDM SELF-TESTS	
• Check the recorded DDM DTCs from the continuous and on-demand self-tests. • **Are any DTCs present?**	**Yes** For DTC B2336, GO to B30 . For DTC B2320 or B2324, GO to B20 . For all other DDM DTCs, REFER to Section 419-10 to continue diagnosis. **No** GO to B2 .
B2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND DRIVER FEM SELF-TESTS	
• Check the recorded FEM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** For DTC B2312 or B2316, GO to B5 . For all other FEM DTCs, REFER to Section 419-10 to continue diagnosis. **No** GO to B3 .
B3 CHECK THE EXTERIOR MIRROR CONTROL PIDS	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Monitor PIDs. • Monitor the DDM PIDs MIRH_SW, MIRV_SW and MIR_SEL, while operating the exterior mirror control switch in each direction. • **Do the DDM PID values agree with the exterior mirror control switch positions?**	**Yes** GO to B4 . **No** GO to B18 .

B4 IDENTIFY THE INOPERATIVE MIRROR	
• Operate the LH and RH exterior mirrors. • **Is the RH exterior mirror inoperative?**	**Yes** GO to B5 . **No** GO to B20 .
B5 CHECK CENTRAL JUNCTION BOX (CJB) FUSE 30 (5A) FOR VOLTAGE	
• Disconnect: CJB Fuse 30 (5A). • Measure the voltage between the CJB fuse 30 (5A) input side, circuit 29S-DK21 (OG/WH), harness side and ground.  A0071668 • **Is the voltage greater than 10 volts?**	**Yes** GO to B6 . **No** REPAIR circuit 29S-DK21 (OG/WH). CLEAR the DTCs. REPEAT the self-test.
B6 CHECK CIRCUIT 29S-DK21 (OG/WH) FOR AN OPEN	
• Connect: CJB Fuse 30 (5A). • Ignition OFF. • Disconnect: FEM C201a. • Ignition ON. • Measure the voltage between the FEM C201a-1, circuit 29S-DK21 (OG/WH), harness side and ground.  A0002461 • **Is the voltage greater than 10 volts?**	**Yes** GO to B7 . **No** VERIFY the CJB fuse 30 (5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B7 CHECK THE RH EXTERIOR MIRROR ACTIVE COMMAND	
• Ignition OFF. • Connect: FEM C201a. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Active Commands. • Select FEM active command POWER MIRROR CONTROL. • Trigger the FEM active commands PR UP,	**Yes** GO to B14 . **No** GO to B8 .

PR DOWN, PR LEFT and PR RIGHT ON and OFF. • **Does the RH exterior mirror function correctly?**	
B8 CHECK FOR VOLTAGE AT THE RH EXTERIOR MIRROR MOTOR	
• Ignition OFF. • Disconnect: RH Exterior Mirror C601. • Ignition ON. • Measure the voltage between the RH exterior mirror, harness side and ground, as follows: **Connector-Pin / Circuit** C601-20 / 32-AD10 (WH/BK) C601-19 / 33-AD10 (YE/BK) C601-17 / 34-AD11 (BU/OG) C601-18 / 35-AD11 (VT/WH)  A0002462 • **Is any voltage present?**	**Yes** GO to B12 . **No** GO to B9 .
B9 CHECK FOR RESISTANCE AT THE RH EXTERIOR MIRROR	
• Ignition OFF. • Measure the resistance between the RH exterior mirror, harness side and ground, as follows: **Connector-Pin / Circuit** C601-20 / 32-AD10 (WH/BK) C601-19 / 33-AD10 (YE/BK) C601-17 / 34-AD11 (BU/OG) C601-18 / 35-AD11 (VT/WH)	**Yes** GO to B10 . **No** GO to B13 .

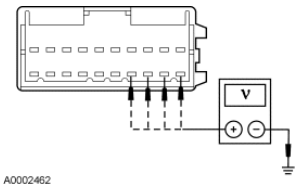


- **Are the resistances greater than 10,000 ohms?**

B10 CHECK FOR AN OPEN AT THE RH EXTERIOR MIRROR ASSEMBLY

- Ignition ON.
- Measure the voltage between the RH exterior mirror, harness side and ground, while moving the exterior mirror control to the listed positions, as follows:

Connector-Pin	Circuit	Mirror Position
C601-20	32-AD10 (WH/BK)	LEFT
C601-19	33-AD10 (YE/BK)	RIGHT
C601-17	34-AD11 (BU/OG)	UP
C601-18	35-AD11 (VT/WH)	DOWN



- **Are the voltages greater than 10 volts for the positions listed?**

Yes
CHECK the exterior mirror jumper harness for open or short circuits, and damaged or pushed out pins. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. REPEAT the self test. If the jumper harness is OK, INSTALL a new exterior mirror. REFER to Exterior Mirror in this section. CLEAR the DTCs. REPEAT the self test.

No
GO to B11 .

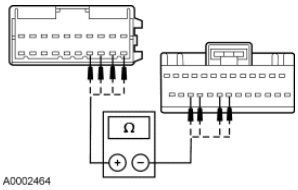
B11 CHECK CIRCUITS 32-AD10 (WH/BK), 33-AD10 (YE/BK), 34-AD11 (BU/OG) AND 35-AD11 (VT/WH) FOR AN OPEN

- Ignition OFF.
- Disconnect: FEM C201e.
- Ignition ON.
- Measure the resistance between the RH exterior mirror harness side, and the FEM harness side, as follows:

Yes
GO to B32 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Connector-Pin	Circuit	Connector-Pin
C601-20	32-AD10 (WH/BK)	C201e-23
C601-19	33-AD10 (YE/BK)	C201e-24
C601-17	34-AD11 (BU/OG)	C201e-20
C601-18	35-AD11 (VT/WH)	C201e-21

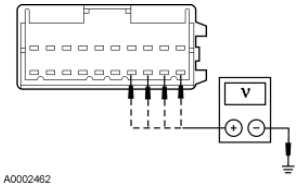


- **Are the resistances less than 5 ohms?**

B12 CHECK CIRCUITS 32-AD10 (WH/BK), 33-AD10 (YE/BK), 34-AD11 (BU/OG), AND 35-AD11 (VT/WH) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: FEM C201e.
- Ignition ON.
- Measure the voltage between the RH exterior mirror, harness side and ground, as follows:

Connector-Pin	Circuit
C601-20	32-AD10 (WH/BK)
C601-19	33-AD10 (YE/BK)
C601-17	34-AD11 (BU/OG)
C601-18	35-AD11 (VT/WH)

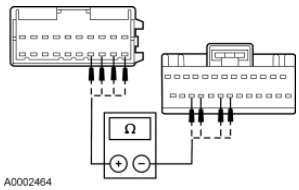


- **Is any voltage present?**

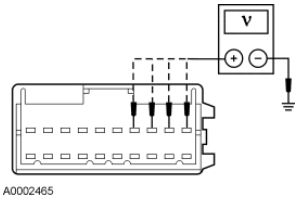
Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to B32 .

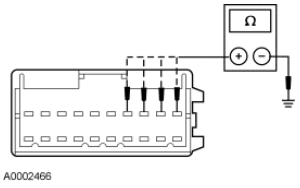
B13 CHECK CIRCUITS 32-AD10 (WH/BK), 33-AD10 (YE/BK), 34-AD11 (BU/OG) AND 35-AD11 (VT/WH) FOR CONTINUITY

• Disconnect: FEM C201e. • Measure the resistance between the RH exterior mirror harness side, and the FEM harness side, as follows: **Connector-Pin / Circuit / Connector-Pin** C601-20 / 32-AD10 (WH/BK) / C201e-23 C601-19 / 33-AD10 (YE/BK) / C201e-24 C601-17 / 34-AD11 (BU/OG) / C201e-20 C601-18 / 35-AD11 (VT/WH) / C201e-21  • **Are the resistances less than 5 ohms?**	**Yes** GO to B32 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
B14 CHECK THE FEM FOR THE CORRECT OUTPUTS	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Monitor PIDs. • Trigger the FEM active commands PR UP, PR DOWN, PR LEFT and PR RIGHT ON and OFF, while monitoring the FEM PIDs MIRH_SW and MIRV_SW. • **Do the FEM PID values agree with the RH exterior mirror commanded positions?**	**Yes** GO to B32 . **No** GO to B15 .
B15 CHECK CIRCUITS 7-AD19 (YE/RD), 8-AD19 (WH/RD), 9-AD19 (BN/RD), AND 10-AD19 (GY/RD) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: RH Exterior Mirror C601. • Ignition ON. • Measure the voltage between the RH exterior mirror, harness side and ground, as follows:	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to B16 .

Connector-Pin	Circuit
C601-7	7-AD19 (YE/RD)
C601-10	8-AD19 (WH/RD)
C601-9	9-AD19 (BN/RD)
C601-8	10-AD19 (GY/RD)

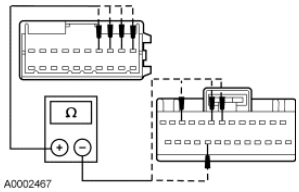


- **Is any voltage present?**

B16 CHECK CIRCUITS 7-AD19 (YE/RD), 8-AD19 (WH/RD), 9-AD19 (BN/RD) AND 10-AD19 (GY/RD) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the RH exterior rear view mirror, harness side and ground, as follows: **Connector-Pin / Circuit** C601-7 — 7-AD19 (YE/RD) C601-10 — 8-AD19 (WH/RD) C601-9 — 9-AD19 (BN/RD) C601-8 — 10-AD19 (GY/RD)  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to B17 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
B17 CHECK CIRCUITS 7-AD19 (YE/RD), 8-AD19 (WH/RD), 9-AD19 (BN/RD) AND 10-AD19 (GY/RD) FOR AN OPEN	
• Disconnect: FEM C201e. • Measure the resistance between the RH exterior rear view mirror, harness side and the FEM, harness side, as follows:	**Yes** CHECK the exterior mirror jumper harness for open or short circuits, and damaged or pushed out pins. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs.

	REPEAT the self test. If the jumper harness is OK, INSTALL a new exterior mirror. REFER to Exterior Mirror in this section. CLEAR the DTCs. REPEAT the self test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Connector-Pin	Circuit	Connector-Pin
C601-7	7-AD19 (YE/RD)	C201e-8
C601-10	8-AD19 (WH/RD)	C201e-7
C601-9	9-AD19 (BN/RD)	C201e-22
C601-8	10-AD19 (GY/RD)	C201e-11

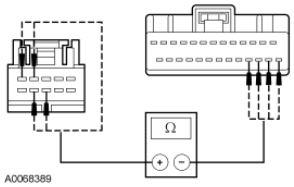


- **Are the resistances less than 5 ohms?**

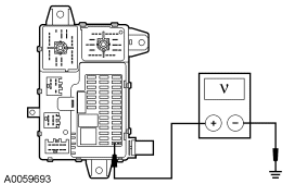
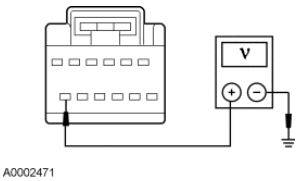
B18 CHECK THE EXTERIOR MIRROR CONTROL SWITCH OPERATION	
• Carry out the exterior mirror control switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the exterior mirror control switch pass the component test?**	**Yes** GO to B19 . **No** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.
B19 CHECK THE EXTERIOR MIRROR CONTROL SWITCH CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: Exterior Mirror Control Switch C527. • Disconnect: DDM C501d. • Measure the resistance between the following exterior mirror control switch, harness side and the DDM, harness side as follows:	**Yes** GO to B33 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

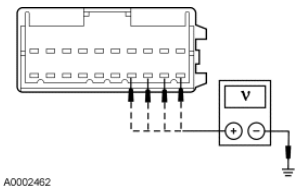
Connector-Pin	Circuit	DDM Pins
C527-5	32-AD30 (WH/BK)	C501d-15
C527-9	32-AD32 (WH/RD)	C501d-17

C527-8	34-AD29 (BU/OG)	C501d-14
C527-4	34-AD31 (BU/WH)	C501d-16

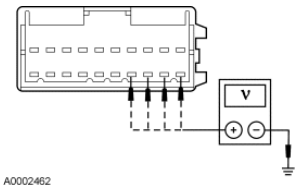


- **Are the resistances less than 5 ohms?**

B20 CHECK CJB FUSE 22 (10A) FOR VOLTAGE	
• Ignition ON. • Disconnect: CJB Fuse 22 (10A). • Measure the voltage between the CJB fuse 22 (10A) input side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to B21 . **No** REPAIR the voltage source to CJB fuse 22 (10A). CLEAR the DTCs. REPEAT the self-test.
B21 CHECK CIRCUIT 29S-AJ86 (OG/BU) FOR AN OPEN	
• Ignition OFF. • Connect: CJB Fuse 22 (10A). • Disconnect: DDM C501a. • Ignition ON. • Measure the voltage between the DDM C501a-12, circuit 29S-AJ86 (OG/BU), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to B22 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B22 CHECK THE LH EXTERIOR MIRROR ACTIVE COMMANDS	
• Ignition OFF.	**Yes** GO to B27 .

• Connect: DDM C501a. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Active Commands. • Select DDM active command menu POWER MIRROR CONTROL. • Trigger the DDM active command DR UP, DR DOWN, DR LEFT and DR RIGHT. • **Does the driver exterior mirror operate correctly?**	**No** GO to B23 .
B23 CHECK FOR VOLTAGE AT THE LH MIRROR MOTORS	
• Ignition OFF. • Disconnect: LH Exterior Mirror C520. • Ignition ON. • Measure the voltage between the LH exterior mirror, harness side and ground, as follows: **Connector-Pin / Circuit** C520-20 — 32-AD7 (WH/RD) C520-19 — 33-AD7 (YE/RD) C520-17 — 34-AD8 (BU/WH) C520-18 — 35-AD8 (VT)  A0002462 • **Is any voltage present?**	**Yes** GO to B31 . **No** GO to B24 .
B24 CHECK FOR OPENS AT THE LH MIRROR ASSEMBLY	
• Measure the voltage between the LH exterior mirror, harness side and ground, while moving the exterior mirror control switch through the listed positions, as follows: **C520 Pin / Circuit / Mirror Position** C520-20 — 32-AD7 (WH/RD) — LEFT	**Yes** CHECK the exterior mirror jumper harness for open or short circuits, and damaged or pushed out pins. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. REPEAT the self test. If the jumper harness is OK, INSTALL a new exterior mirror. REFER to Exterior Mirror in this section. CLEAR the DTCs. REPEAT the self test. **No** GO to B25 .

C520-19	33-AD7 (YE/RD)	RIGHT
C520-17	34-AD8 (BU/WH)	UP
C520-18	35-AD8 (VT)	DOWN



- **Are the voltages greater than 10 volts?**

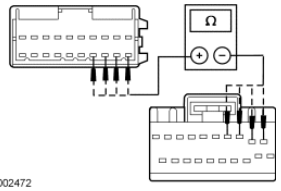
B25 CHECK FOR RESISTANCE AT THE LH EXTERIOR MIRROR

- Ignition OFF.
- Disconnect: DDM C501c.
- Measure the resistance between the LH exterior mirror, harness side and the DDM harness side, as follows:

Yes
GO to B26 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Connector-Pin	Circuit	Connector-Pin
C520-20	32-AD7 (WH/RD)	C501c-1
C520-19	33-AD7 (YE/RD)	C501c-2
C520-17	34-AD8 (BU/WH)	C501c-3
C520-18	35-AD8 (VT)	C501c-4

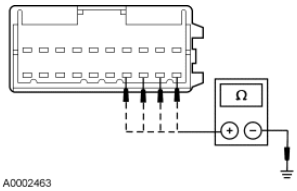


- **Are the resistances less than 5 ohms?**

B26 CHECK CIRCUITS 32-AD7 (WH/RD), 33-AD7 (YE/RD), 34-AD8 (BU/WH) AND 35-AD8 (VT) FOR A SHORT TO GROUND

<table>
<tr><td>
• Measure the resistance between the LH exterior mirror, harness side and ground, as follows:

<table>
<tr><th>Connector-Pin</th><th>Circuit</th></tr>
<tr><td>C520-20</td><td>32-AD7 (WH/RD)</td></tr>
<tr><td>C520-19</td><td>33-AD7 (YE/RD)</td></tr>
<tr><td>C520-17</td><td>34-AD8 (BU/WH)</td></tr>
<tr><td>C520-18</td><td>35-AD8 (VT)</td></tr>
</table>

 
A0002463
• Are the resistances greater than 10,000 ohms?
</td><td>
Yes
GO to B33 .

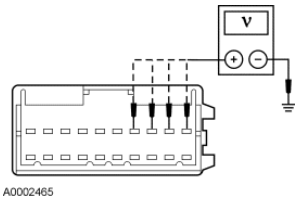
No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
</td></tr>
<tr><td>B27 CHECK THE DDM FOR THE CORRECT OUTPUTS</td><td></td></tr>
<tr><td>
• Enter the following diagnostic mode on the scan tool: Active Commands.
• Select the DDM active command menu POWER MIRROR CONTROL.
• Trigger the DDM active command DR UP, DR DOWN, DR LEFT and DR RIGHT; ON and OFF while monitoring the DDM PIDs MIRH_SW and MIRV_SW.
• Do the PID values agree with the LH exterior mirror commanded positions?
</td><td>
Yes
GO to B33 .

No
GO to B28 .
</td></tr>
<tr><td>B28 CHECK CIRCUITS 7-AD18 (YE/BK), 8-AD18 (WH/BK), 9-AD18 (BN/YE) AND 10-AD18 (GY/BK) FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>
• Ignition OFF.
• Disconnect: LH Exterior Mirror C520.
• Disconnect: DDM C501c.
• Ignition ON.
• Measure the voltage between the LH exterior mirror, harness side and ground, as follows:

<table>
<tr><th>Connector-Pin</th><th>Circuit</th></tr>
</table>
</td><td>
Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to B29 .
</td></tr>
</table>

C520-7	7-AD18 (YE/BK)
C520-10	8-AD18 (WH/BK)
C520-9	9-AD18 (BN/YE)
C520-8	10-AD18 (GY/BK)

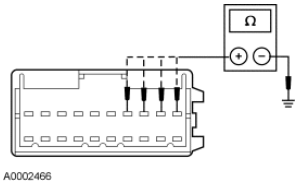


- **Is any voltage present?**

B29 CHECK CIRCUITS 7-AD18 (YE/BK), 8-AD18 (WH/BK), 9-AD18 (BN/YE) AND 10-AD18 (GY/BK) FOR A SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the LH exterior mirror, harness side and ground, as follows:

Connector-Pin	Circuit
C520-7	7-AD18 (YE/BK)
C520-10	8-AD18 (WH/BK)
C520-9	9-AD18 (BN/YE)
C520-8	10-AD18 (GY/BK)



- **Are the resistances greater than 10,000 ohms?**

Yes
GO to B30 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

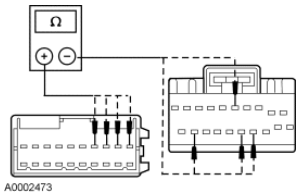
B30 CHECK CIRCUITS 7-AD18 (YE/BK), 8-AD18 (WH/BK), 9-AD18 (BN/YE) AND 10-AD18 (GY/BK) FOR AN OPEN

- Ignition OFF.
- Disconnect: LH Exterior Mirror C520.
- Disconnect: DDM C501c.
- Measure the resistance between the LH exterior mirror, harness side and the DDM, harness side as follows:

Yes
CHECK the exterior mirror jumper harness for open or short circuits, and damaged or pushed out pins. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. CLEAR the DTCs. REPEAT the self test. If the jumper harness is OK, INSTALL a new exterior mirror. REFER to

	Exterior Mirror in this section. CLEAR the DTCs. REPEAT the self test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

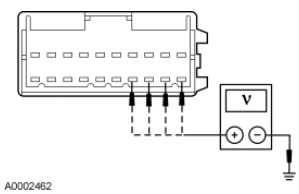
Connector-Pin	Circuit	Connector-Pin
C520-7	7-AD18 (YE/BK)	C501c-5
C520-10	8-AD18 (WH/BK)	C501c-14
C520-9	9-AD18 (BN/YE)	C501c-19
C520-8	10-AD18 (GY/BK)	C501c-15



- **Are the resistances less than 5 ohms?**

B31 CHECK FOR VOLTAGE AT THE LH EXTERIOR MIRROR ASSEMBLY	
• Ignition OFF. • Disconnect: DDM C501c. • Ignition ON. • Measure the voltage between the LH exterior mirror, harness side and ground, as follows:	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to B33 .

Connector-Pin	Circuit
C520-20	32-AD7 (WH/RD)
C520-19	33-AD7 (YE/RD)
C520-17	34-AD8 (BU/WH)
C520-18	35-AD8 (VT)



- **Is any voltage present?**

B32 CHECK FOR CORRECT FEM OPERATION	
	Yes

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	INSTALL a new FEM. REFER to Section 419-10 . REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

B33 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The Auto-Dimming Mirror Does Not Operate Correctly

Normal Operation

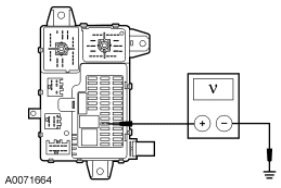
The auto-dimming mirror receives voltage from circuit 75-AD15 (YE/BU) and ground from circuit 31-AD15 (BK/OG). When the transmission is in REVERSE, the digital transmission range (TR) sensor signals the powertrain control module (PCM) the transmission range. The PCM sends a signal to the rear electronic module (REM) over the standard corporate protocol (SCP) communication link, at which time the REM sends a voltage through circuit 8-AD15 (WH/BU) to the auto-dimming interior mirror, which turns the dimming feature off. Then the auto-dimming interior mirror sends voltage through circuit 7AD-15 (YE/BU) to the LH exterior mirror, which turns the dimming feature off.

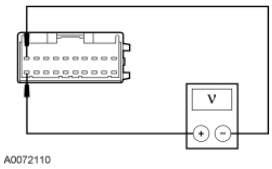
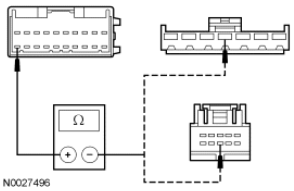
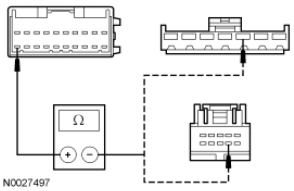
Possible Causes

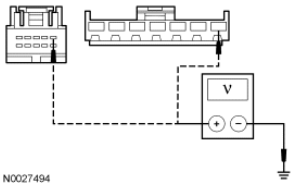
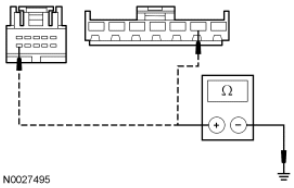
- circuit 8-AD15 (WH/BU) open, short to ground or short to voltage
- circuit 9-AD15 (BN/BU) open
- circuit 31-AD15 (BK/OG) open
- circuit 75-AD15 (YE/BU) open
- auto-dimming interior mirror
- LH auto-dimming exterior mirror
- REM

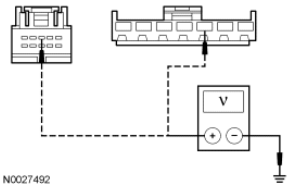
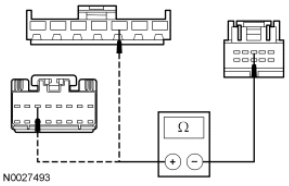
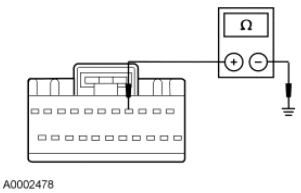
PINPOINT TEST C: THE AUTO-DIMMING MIRROR DOES NOT OPERATE CORRECTLY

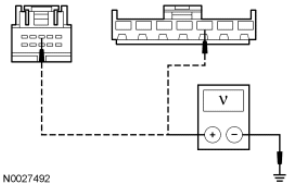
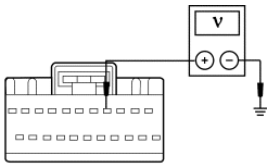
Test Step	Result / Action to Take
C1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND REM SELF-TESTS	

• Check the recorded results from the REM continuous and on-demand self-tests. • **Are any DTCs present?**	**Yes** REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index to continue diagnosis of the DTCs. **No** GO to C2 .
C2 CHECK VOLTAGE TO CENTRAL JUNCTION BOX (CJB) FUSE 12 (5A)	
• Disconnect: CJB Fuse 12 (5A). • Ignition ON. • Measure the voltage between the CJB fuse 12 (5A) input terminal and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to C3 . **No** REPAIR the voltage supply to the fuse. CLEAR the DTCs. REPEAT the self-test.
C3 IDENTIFY THE INOPERATIVE AUTO-DIMMING MIRROR	
• Activate the auto-dimming mirrors. • **Is the interior auto-dimming mirror functioning correctly?**	**Yes** GO to C4 . **No** GO to C7 .
C4 CHECK THE INTERIOR MIRROR OUTPUT TO THE LH EXTERIOR MIRROR	
• Disconnect: LH Exterior Mirror C520. • Ignition ON. • ⚠ **CAUTION: Make sure the engine is not running. The ignition switch should be in the ON position with the engine off.** • Engage the parking brake and shift the transmission to the REVERSE position. • Measure the voltage between the LH exterior mirror C520-1, circuit 7-AD15 (YE/BU), harness side and the LH exterior mirror C520-11, circuit 9-AD15 (BN/BU), harness side.	**Yes** INSTALL a new LH exterior mirror. REFER to Exterior Mirror in this section. **No** GO to C5 .

 A0072110 • **Is the voltage approximately 1.2 volts?**	
C5 CHECK CIRCUIT 7-AD15 (YE/BU) FOR AN OPEN	
• Ignition OFF. • Disconnect: Interior Rear View Mirror C9012 (without navigation), Interior Rear View Mirror C911 (with navigation). • Measure the resistance between the LH exterior mirror C520-1, circuit 7-AD15 (YE/BU), harness side and the interior rear view mirror C9012-4 (without navigation), C911-8 (with navigation), circuit 7-AD15 (YE/BU), harness side.  N0027496 • **Is the resistance less than 5 ohms?**	**Yes** GO to C6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C6 CHECK CIRCUIT 9-AD15 (BN/BU) FOR AN OPEN	
• Measure the resistance between the LH exterior mirror C520-11 circuit 9-AD15 (BN/BU), harness side and the interior rear view mirror C9012-5 (without navigation), C911-7 (with navigation), circuit 9-AD15 (BN/BU), harness side.  N0027497 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new interior rear view mirror. REFER to Interior Rear View Mirror in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C7 CHECK CIRCUIT 75-AD15 (YE/BU) FOR AN OPEN	

• Ignition OFF. • Connect: CJB Fuse 12 (5A). • Disconnect: Auto-Dimming Interior Mirror C911 (with navigation), C9012 (without navigation). • Ignition ON. • Measure the voltage between the auto-dimming interior mirror C9012-1 (without navigation), C911-1 (with navigation), circuit 75-AD15 (YE/BU), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to C8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C8 CHECK CIRCUIT 31-AD15 (BK/OG) FOR AN OPEN	
• Measure the resistance between the auto-dimming interior mirror C9012-2 (without navigation), C911-10 (with navigation), circuit 31-AD15 (BK/OG), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to C9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C9 CHECK THE REM OUTPUT	
• Ignition ON. • ⚠ **CAUTION: Make sure the engine is not running. The ignition switch should be in the RUN position with the engine off.** • Engage the parking brake and shift the transmission to the REVERSE position. • Measure the voltage between the auto-dimming interior mirror C9012-3 (without navigation), C911-3 (with navigation), circuit 8-AD15 (WH/BU), harness side and ground.	**Yes** GO to C12 . **No** GO to C10 .

 N0027492 • **Is the voltage greater than 10 volts?**	
C10 CHECK CIRCUIT 8-AD15 (WH/BU) FOR AN OPEN	
• Select PARK. • Ignition OFF. • Disconnect: REM C420b. • Measure the resistance between the auto-dimming interior mirror C9012-3 (without navigation), C911-3 (with navigation), circuit 8-AD15 (WH/BU), harness side and the REM C420b-4, circuit 8-AD15 (WH/BU), harness side.  N0027493 • **Is the resistance less than 5 ohms?**	**Yes** GO to C11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C11 CHECK CIRCUIT 8-AD15 (WH/BU) FOR A SHORT TO GROUND	
• Measure the resistance between the REM C420b-4, circuit 8-AD15 (WH/BU), harness side and ground.  A0002478 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C14 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C12 CHECK FOR THE CORRECT OUTPUT TO THE MIRROR	
• Select PARK. • Measure the voltage between the auto-dimming interior mirror C9012-3 (without navigation), C911-3 (with navigation), circuit 8-AD15 (WH/BU), harness side and ground.	**Yes** GO to C13 . **No** INSTALL a new auto-dimming interior mirror. REFER to Interior Rear View Mirror in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 N0027492 • **Is the voltage greater than 10 volts?**	If the auto-dimming feature continues to function incorrectly, GO to C14 .
C13 CHECK CIRCUIT 8-AD15 (WH/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: REM C420b. • Ignition ON. • Measure the voltage between the REM C420b-4, circuit 8-AD15 (WH/BU), harness side and ground.  A0002479 • **Is voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to C14 .
C14 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Memory Mirror Is Inoperative

Normal Operation

The driver door module (DDM) sends a voltage reference (VREF) to the memory set switch on circuits 8-AH32 (WH/BU), 8-AH31 (WH/RD) and 8-AH27 (WH). When memory set switch button 1 or 2 is pressed (within 5 seconds of pressing memory set button 3), the VREF on the circuits to the pressed buttons are grounded, providing inputs to the DDM. Once the DDM receives the inputs from memory set button 3; then 1 (or 2), the DDM saves the current mirror settings using the inputs from the exterior mirror position sensors. When the DDM receives an input from the memory set switch button 1, circuit 8-AH31 (WH/RD) or button 2, circuit 8-AH32 (WH/BU) the DDM adjusts the driver mirror accordingly and sends a signal to the front electronic module (FEM) over the standard corporate protocol (SCP) communication link to adjust the passenger mirror as per the memory set switch button.

The DDM receives inputs on the position of the LH exterior mirror from circuits 8-AD18 (WH/BK), 7-AD18 (YE/BK), 10-AD18 (GY/BK) and 9-AD18 (BN/YE) while the FEM receives inputs on the RH exterior mirror from circuits 8-AD19 (WH/RD), 7-AD19 (YE/RD), 10-AD19 (GY/RD) and 9-AD19 (BN/RD).

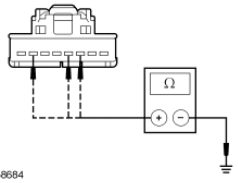
Possible Causes

- circuit 8-AH27 (WH) open or short to ground
- circuit 8-AH31 (WH/RD) open or short to ground
- circuit 8-AH32 (WH/BU) open or short to ground
- circuit 31-AH27 (BK) open
- DDM
- memory set switch

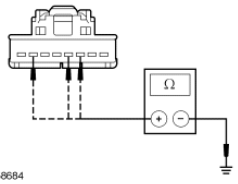
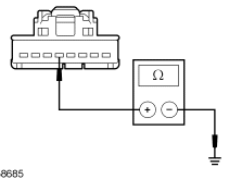
PINPOINT TEST D: THE MEMORY MIRROR IS INOPERATIVE

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>D1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND DDM SELF-TESTS</td><td></td></tr>
<tr><td>• Check the recorded results from the DDM continuous and on-demand self-tests.
• Is DTC B1534, B1538 or B1530 present?</td><td>Yes
GO to D2 .

No
GO to D4 .</td></tr>
<tr><td>D2 CHECK THE MEMORY SET SWITCH CIRCUITS AND DDM FOR A SHORT TO GROUND</td><td></td></tr>
<tr><td>• Disconnect: Memory Set Switch C503.
• Measure the resistance between the memory set switch, harness side and ground, as follows:

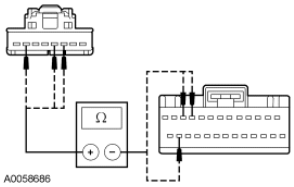
<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>C503-4</td><td>8-AH27 (WH)</td></tr><tr><td>C503-3</td><td>8-AH32 (WH/BU)</td></tr><tr><td>C503-7</td><td>8-AH31 (WH/RD)</td></tr></table>
 
A0058684
• Are the resistances greater than 10,000 ohms?</td><td>Yes
INSTALL a new memory set switch. CLEAR the DTCs. REPEAT the self-test.

No
GO to D3 .</td></tr>
<tr><td>D3 CHECK CIRCUITS 8-AH27 (WH), 8-AH31 (WH/RD), AND 8-AH32 (WH/BU), FOR A SHORT TO GROUND</td><td></td></tr>
</table>

• Disconnect: DDM C501d. • Measure the resistance between the memory set switch, harness side and ground, as follows: | Connector-Pin	Circuit | |---|---| | C503-4 | 8-AH27 (WH) | | C503-7 | 8-AH31 (WH/RD) | | C503-3 | 8-AH32 (WH/BU) |  A0058684 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to D8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK THE MEMORY SET SWITCH USING THE DDM PIDS	
• Enter the following diagnostic mode on the scan tool: Monitor PIDs. • Monitor the DDM PIDs MEMS_SW, MEM1_SW and MEM2_SW, while actuating the memory set switch buttons. • **Do the DDM PID values agree with the memory set switch positions?**	**Yes** GO to D8 . **No** GO to D5 .
D5 CHECK CIRCUIT 31-AH27 (BK) FOR AN OPEN	
• Disconnect: Memory Set Switch C503. • Measure the resistance between the memory set switch C503-5, circuit 31-AH27 (BK), harness side and ground.  A0058685 • **Is the resistance less than 5 ohms?**	**Yes** GO to D6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D6 CHECK FOR AN OPEN CIRCUIT BETWEEN THE DDM AND THE MEMORY SET SWITCH	
• Disconnect: DDM C501d. • Measure the resistance between the DDM, harness side, and the memory set switch, harness side as follows:	**Yes** GO to D7 . **No** REPAIR the circuit. CLEAR the

	DTCs. REPEAT the self-test.

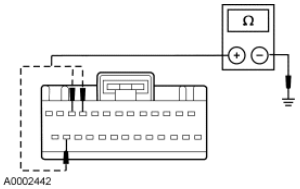
Connector-Pin	Circuit	Connector-Pin
C501d-25	8-AH27 (WH)	C503-4
C501d-10	8-AH31 (WH/RD)	C503-7
C501d-11	8-AH32 (WH/BU)	C503-3



- **Are the resistances less than 5 ohms?**

D7 CHECK THE MEMORY SET SWITCH FOR AN OPEN	
• Connect: Memory Set Switch C503. • Measure the resistance between the DDM, harness side and ground, while activating the indicated memory set switch button as follows:	**Yes** GO to D8 . **No** INSTALL a new memory set switch. CLEAR the DTCs. REPEAT the self-test.

Connector-Pin	Circuit	Memory Set Switch Button
C501d-25	8-AH27 (WH)	SET
C501d-10	8-AH31 (WH/RD)	MEMORY 1
C501d-11	8-AH32 (WH/BU)	MEMORY 2



- **Is the resistance less than 5 ohms when each button is pressed?**

D8 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . REPEAT the self-test.
	
	No

• Connect all the DDM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Memory Mirror Is Inoperative — Memory Set Switch LED

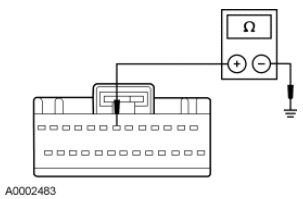
Normal Operation

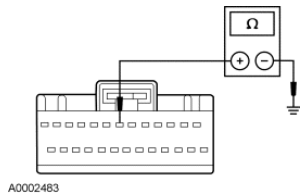
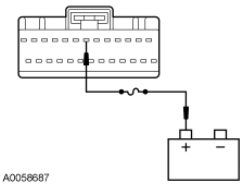
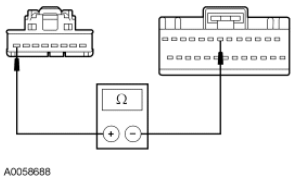
The driver door module (DDM) sends vehicle power (VPWR) to the memory set switch LED on circuit 7S-AH27 (YE) whenever the SET or memory buttons 1 or 2 are pressed. The memory set switch LED is grounded at all times by circuit 31-AH27 (BK). When the DDM sends VPWR to the memory set switch LED, the LED illuminates.

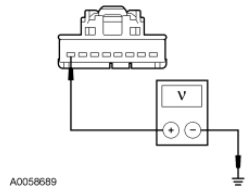
Possible Causes

- circuit 7S-AH27 (YE) open, short to ground or short to voltage
- DDM
- memory set switch

PINPOINT TEST E: THE MEMORY MIRROR IS INOPERATIVE — MEMORY SET SWITCH LED

Test Step	Result / Action to Take
E1 CHECK THE MEMORY SET SWITCH LED	
• Operate the memory set switch. • **Is the memory set switch LED always on?**	**Yes** GO to E6 . **No** GO to E2 .
E2 CHECK CIRCUIT 7S-AH27 (YE) FOR RESISTANCE	
• Disconnect: DDM C501d. • Measure the resistance between the DDM C501d-7, circuit 7S-AH27 (YE), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E4 . **No** GO to E3 .
E3 CHECK CIRCUIT 7S-AH27 (YE) FOR A SHORT TO GROUND	

• Disconnect: Memory Set Switch C503. • Measure the resistance between the DDM C501d-7, circuit 7S-AH27 (YE), harness side and ground.  A0002483 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new memory set switch. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E4 CHECK THE DDM OUTPUT	
• Connect a fused (5A) jumper wire between the DDM C501d-7, circuit 7S-AH27 (YE), harness side and battery voltage.  A0058687 • **Does the memory set switch LED illuminate?**	**Yes** GO to E8 . **No** GO to E5 .
E5 CHECK CIRCUIT 7S-AH27 (YE) FOR AN OPEN	
• Disconnect: Memory Set Switch C503. • Measure the resistance between the memory set switch C503-8, circuit 7S-AH27 (YE), harness side and DDM C501d-7, circuit 7S-AH27 (YE), harness side.  A0058688 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new memory set switch. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E6 CHECK THE DDM FOR AN INTERNAL SHORT TO VOLTAGE	
• Disconnect: DDM C501d. • **Does the memory set switch LED turn OFF?**	**Yes** GO to E8 . **No** GO to E7 .

E7 CHECK CIRCUIT 7S-AH27 (YE) FOR A SHORT TO VOLTAGE	
• Disconnect: Memory Set Switch C503. • Measure the voltage between the memory set switch C503-8, circuit 7S-AH27 (YE), harness side and ground.  • **Is voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new memory set switch. CLEAR the DTCs. REPEAT the self-test.
E8 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Heated Exterior Mirror(s) Does Not Defrost

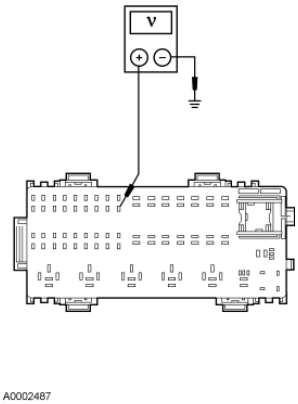
Normal Operation

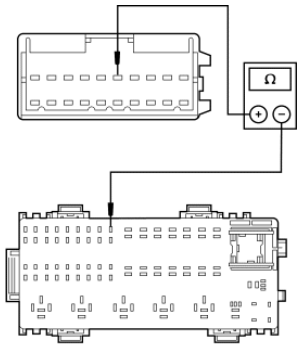
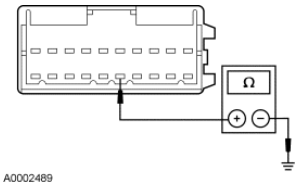
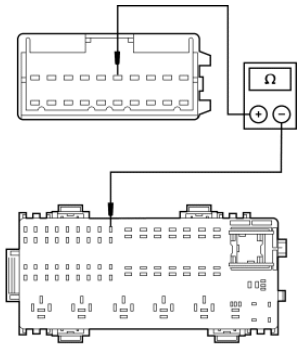
With the engine running and the heated rear window ON, the heated exterior mirrors receive voltage from the heated rear window relay through circuit 15S-DA13 (GN/YE) to circuit 15S-DC1 (GN/YE) through battery junction box (BJB) fuse 9 (5A) to circuit 29S-HB1 (OG/YE) to 29-HB35 (OG/BK) (left) or 29-HB36 (OG/GN) (right). The heated exterior mirrors are grounded through circuit 31-HB35 (BK/GN) (left) and 31-HB36 (BK/RD) (right).

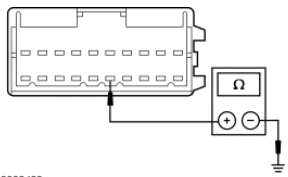
Possible Causes

- circuit 15S-DA13 (GN/YE) open
- circuit 15S-DC1 (GN/YE) open
- circuit 29-HB35 (OG/BK) open
- circuit 29-HB36 (OG/GN) open
- circuit 29S-HB1 (OG/YE) open
- circuit 31-HB35 (BK/GN) open
- circuit 31-HB36 (BK/RD) open
- heated exterior mirror(s)
- Heated rear window relay
- Rear electronic module (REM)

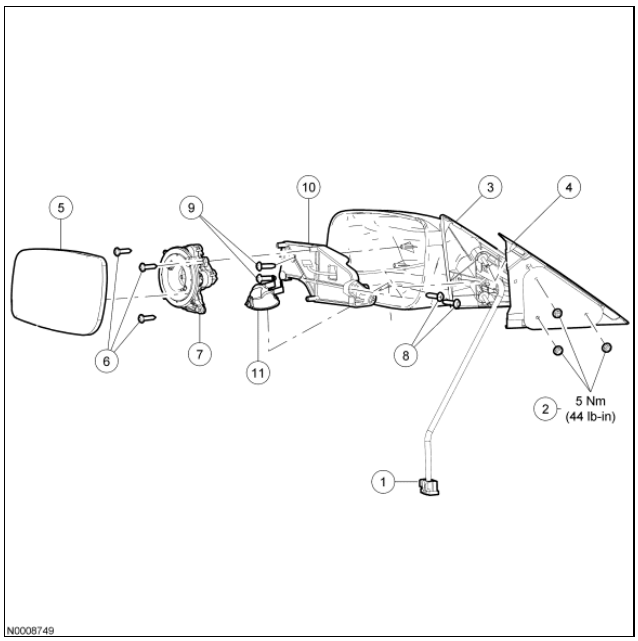
PINPOINT TEST F: THE HEATED EXTERIOR MIRRORS DOES NOT DEFROST

Test Step	Result / Action to Take
F1 CHECK THE HEATED REAR WINDOW OPERATION	
• Select PARK. • Start the engine. • Press the heated rear window switch to ON. • **Does the heated rear window defrost or warm up?**	**Yes** GO to F2 . **No** REFER to Section 501-11 to diagnose the heated rear window system.
F2 CHECK THE HEATED FUNCTION OF THE EXTERIOR MIRRORS	
• Check the heated function of the exterior mirrors. • **Is the heated function of both exterior mirrors inoperative?**	**Yes** GO to F3 . **No** For the driver exterior mirror, GO to F4 . For the passenger exterior mirror, GO to F6 .
F3 CHECK CIRCUIT 15S-DC1 (GN/YE) FOR VOLTAGE	
• Ignition OFF. • Disconnect: BJB Fuse 9 (5A). • Start the engine. • Press the heated rear window switch to ON. • Measure the voltage between the BJB fuse 9 (5A) input pin, circuit 15S-DC1 (GN/YE), and ground.  A0002487 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit 29S-HB1 (OG/YE). TEST the system for normal operation. **No** REPAIR circuit 15S-DC1 (GN/YE). TEST the system for normal operation.
F4 CHECK CIRCUIT 29S-HB1 (OG/YE) FOR AN OPEN	
• Ignition OFF. • Disconnect: BJB Fuse 9 (5A). • Disconnect: Driver Exterior Mirror C520. • Measure the resistance between the driver exterior mirror C520-6, circuit 29-HB35 (OG/BK), harness side and the BJB fuse 9 (5A) output terminal, circuit 29S-HB1 (OG/YE).	**Yes** GO to F5 . **No** REPAIR circuit 29-HB35 (OG/BK). TEST the system for normal operation.

 A0002488 • **Is the resistance less than 5 ohms?**	
F5 CHECK CIRCUIT 31-HB35 (BK/GN) FOR AN OPEN	
• Measure the resistance between the driver exterior mirror C520-16, circuit 31-HB35 (BK/GN), harness side and ground.  A0002489 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver exterior mirror. REFER to Exterior Mirror in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
F6 CHECK CIRCUIT 29-HB36 (OG/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: BJB Fuse 9 (5A). • Disconnect: Passenger Exterior Mirror C601. • Measure the resistance between the passenger exterior mirror C601-6, circuit 29-HB36 (OG/GN), harness side and the BJB fuse 9 (5A) output terminal, circuit 29S-HB1 (OG/YE).  A0002488 • **Is the resistance less than 5 ohms?**	**Yes** GO to F7 . **No** REPAIR circuit 29-HB36 (OG/GN). TEST the system for normal operation.
F7 CHECK CIRCUIT 31-HB36 (BK/RD) FOR AN OPEN	

• Measure the resistance between the passenger exterior mirror C601-16, circuit 31-HB36 (BK/RD), harness side and ground.  A0002489 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new passenger exterior mirror. REFER Exterior Mirror in this section. TEST the system for normal operation. **No** REPAIR circuit 31-HB36 (BK/RD). TEST the system for normal operation.

Exterior Mirrors — Exploded View



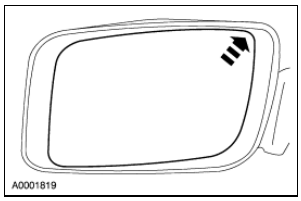
Item	Part Number	Description
1	—	Electrical connector (part of 17682/17683)
2	—	Exterior mirror nuts (3 required)
3	17682/17683	Exterior mirror housing
4	—	Gasket (part of 17682/17683)
5	17K707	Exterior mirror glass
6	—	Exterior mirror motor screws (part of 17682/17683) (3 required)
7	17D696	Exterior mirror motor (part of 17682/17683)
8	—	Exterior mirror frame screws (part of 17682/17683) (2 required)
9	—	Exterior mirror frame screws (part of 17682/17683) (2 required)
10	—	Exterior mirror frame (part of 17682/17683)
11	13B375	Puddle lamp (part of 17682/17683)

1. For additional information, refer to the procedures in this section.

Exterior Mirror Glass

Removal and Installation

1. Push in the upper inboard area of the exterior mirror glass to access the mirror release tab.



2. **NOTE:** The mirror release tab is accessed from the lower out board corner.

   Release the tab from the mirror motor, pull outward until the exterior mirror glass is released.

   - If equipped, disconnect the heated mirror electrical connectors.

3. ⚠ **WARNING: Place a shop towel between the exterior mirror glass and the hand to avoid personal injury in the instance of glass breakage. Failure to follow this instruction may result in personal injury.**

   To install, reverse the removal procedure.

Exterior Mirror Motor

Removal and Installation

1. Remove the exterior mirror glass. For additional information, refer to Exterior Mirror Glass in this section.
2. Remove the 3 exterior mirror motor screws.
3. Disconnect the exterior mirror motor electrical connector.
4. Remove the exterior mirror motor.
5. To install, reverse the removal procedure.

Exterior Mirror

Removal and Installation

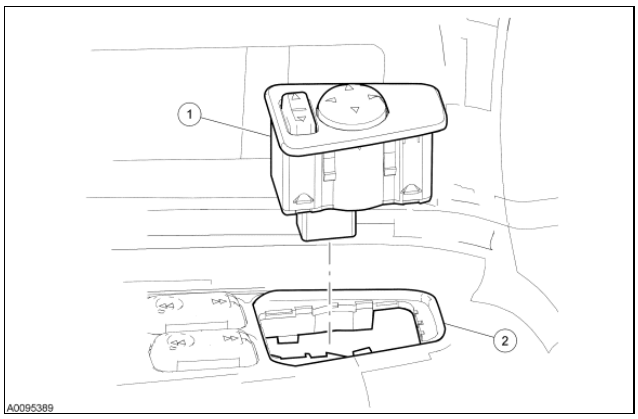
1. Remove the front door trim panel. For additional information, refer to Section 501-05 .

2. Disconnect the exterior mirror electrical connector.

3. Remove the 3 nuts and the exterior mirror.
   - To install, tighten to 5 Nm (44 lb-in)

4. To install, reverse the removal procedure.

Exterior Mirror Control Switch



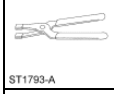
Item	Part Number	Description
1	17B676	Exterior mirror control switch
2	14528B	Door trim panel switch bezel

Removal and Installation

1. Lift up on the front of the door trim panel switch bezel and press the retaining tabs to remove the exterior mirror control switch.
2. Disconnect the exterior mirror control switch electrical connector.
3. To install, reverse the removal procedure.

Interior Rear View Mirror

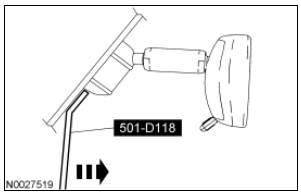
Special Tool(s)

 ST1793-A	Installer, Rear View Mirror 501-025 (T94P-17700-AH)
ST2833-A	Mirror Remover 501-D118

Removal

1. ***NOTICE:*** **Twisting the interior rear view mirror base from right to left may cause a stress fracture to the windshield.**

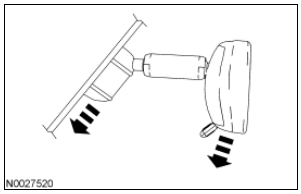
   Insert the Mirror Remover between the mirror mount and windshield bracket from the bottom.



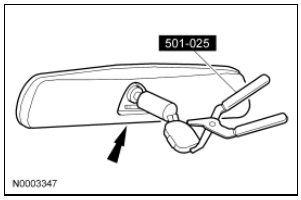
2. Release the mirror mount from windshield bracket by pulling the Mirror Remover away from the windshield.

Installation

1. Slide the mirror mount over the windshield bracket from the top and adjust the mirror to the upward position.



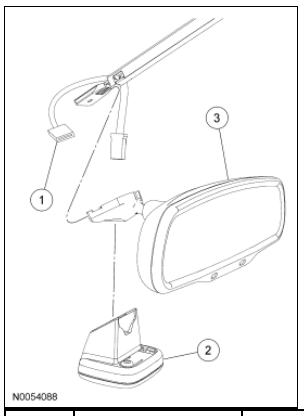
2. Using the Rear View Mirror Installer, press the mirror assembly downward along the windshield until the mount is seated on the windshield bracket.



Auto-Dimming Interior Mirror

Special Tool(s)

ST2833-A	Mirror Remover 501-D118



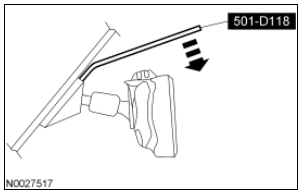
Item	Part Number	Description
1	—	Interior auto-dimming mirror electrical connector (part of 14A005)
2	19A548	Compass module
3	17700	Interior auto-dimming mirror

Removal

1. Remove the wire cover.
2. Disconnect the electrical connector.
3. **NOTE:** If equipped, the compass module does not need to be removed prior to this step.

   NOTE: High level mirror shown, others similar.

   Insert the special tool between the mirror mount and windshield bracket from the top.



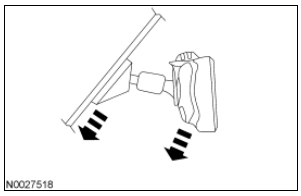
4. If equipped, separate the compass module from the mirror assembly by disengaging the compass module locking tabs.

5. ***NOTICE:*** **Twisting the interior rear view mirror base from right to left may cause a stress fracture to the windshield.**

   Release the mirror mount from the windshield bracket by pulling the tool and mirror down and away from the windshield.

Installation

1. Slide the mirror mount over the windshield bracket from the top and adjust the mirror to the upward position.



2. Quickly press the mirror assembly downward along the windshield until a click is felt. The click indicates the base is engaged to the windshield bracket.

3. Connect the electrical connector and wire cover.

4. If equipped, install the compass module. Check the compass zone and calibration. For additional information, refer to Section 413-01 .

Torque Specifications

Description	Nm	lb-ft	lb-in
Front seat track-to-floor fasteners	47	35	—
Safety belt anchor nut	40	30	—
Front seat side air bag module or seat side thorax air bag module nuts	7	—	62
Front seat track-to-cushion pan nuts	20	15	—
Front seat safety belt buckle bolt	40	30	—
Front seat backrest-to-cushion bolts	25	18	—
Rear seat bolster nuts	11	8	—
Rear seat 60 percent seat backrest nuts	17	13	—
Rear seat 40 percent seat backrest nuts	17	13	—

Seats

Front Seats

The front seats have the following features:

- Driver memory
- Power lumbar (optional)
- Manual lumbar
- Horizontal, vertical front and rear tilt adjustments (driver)
- Horizontal, vertical front tilt adjustment (passenger)
- Power recline
- Climate controlled (optional)

Adjustment of the seat may be accomplished with the seat control switch located on the side of the seat.

Rear Seats

The rear seat has the following features:

- Fold-down seat backrest
- Removable cushion retained by 2 latches located at the front of the cushion
- Two rear bolsters on each side of the rear seat backrest
- Heated (optional)

Fold down the rear seat backrest by releasing the 2 levers in the luggage compartment.

Power Seat Recliner

The power recliner tilts the seat backrest rearward or forward and is controlled by the seat control switch.

The power recliner cannot be repaired separately. If the power recliner needs to be repaired, a new front seat backrest frame must be installed.

Power Lumbar Support

The seat has an electro-mechanical front seat backrest pad adjuster. The lumbar switch adjustment is on the side of the seat.

Manual Lumbar Support

The manual front seat backrest lumbar is adjusted by a knob mounted on the front of the seat cushion.

Memory Seat

This system allows automatic positioning of the driver seat, outside rearview mirrors and power adjusted tilt/telescope steering column, to 2 programmable positions.

The memory seat control is located on the driver door.

Climate Controlled Seats

The climate controlled seat system is able to heat and cool the front seats. Each climate controlled front seat is controlled by a switch on the dual automatic temperature control unit (DATC). Perforated Nudo leather is the only material available for the heated/cooled seats.

Seat Side Air Bag or Seat Side Thorax Air Bag

Driver and passenger seat side air bags or seat side thorax air bag are attached to the seat backrest frame. For diagnostic information or if the seat side air bag or seat side thorax air bag has been deployed, refer to Section 501-20B .

The front seat backrest trim covers cannot be repaired. If the front seat backrest covers need to be repaired, a new cover must be installed. Cleaning the front seat backrest cover is permissible.

If a seat side air bag or seat side thorax air bag deployment took place, a new seat back pad, trim cover and side air bag module must be installed. Install a new seat backrest frame if necessary.

Driver Seat Module

The driver seat module is attached to the driver seat track. For additional information, refer to Section 419-10 for removal and installation procedures.

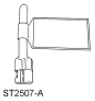
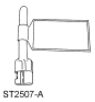
Seats

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
 ST2507-A	Diagnostic Tool, Restraint System (2 required) 418-133
 ST2507-A	Diagnostic Tool, Restraint System (2 required) 501-097

Restraint System Diagnostic Tool Warning

⚠ WARNING: The restraint system diagnostic tools are for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

Principles of Operation

Driver Power Seat — Memory

NOTE: The memory power seat track may stall when operating at 0°C (32°F) or below. Once the vehicle's interior temperature rises above 0°C (32°F), normal operation should return.

The driver power seat is controlled by the driver seat module (DSM). The DSM does not need to be configured, however the driver seat does need to be calibrated when the DSM is installed. The driver seat control switch provides voltage to the DSM when activated. The NEUTRAL position of each driver seat control switch position is a ground state through the seat control switch contacts. A voltage input causes the DSM to power the appropriate motor until the input is removed. Ground is the normal state of the motor circuits through the DSM and is not switched to control the motors. The DSM internally switches the appropriate line from ground to power to adjust the motors.

As the seat is adjusted, the DSM constantly monitors the motor position sensors to record the current seat position. The DSM will remove power from the motor upon termination of the seat control switch input or if the DSM does not see movement from the motor by monitoring the position sensor. The DSM must be calibrated to the seat track it is controlling. For additional information, refer to Seat Calibration. Once the DSM is calibrated to the seat track, it will only allow movement within the calibrated range.

Seat Calibration

The DSM is calibrated using a diagnostic tool. The calibration procedure automatically powers the driver power seat through its full range of motion and records the FULL STOP positions by monitoring the motor position sensors. Once the FULL STOP positions or range of the seat have been recorded, the DSM will only operate within the calibrated range. Any input attempting to drive the seat beyond the calibrated range will be ignored. This calibration is used for all seat control functions including manual switch control and memory recall positioning. During the seat calibration, the DSM may identify a function that is inoperative, such as a position sensor not changing. If the DSM identifies a concern that has a related diagnostic trouble code (DTC), the DSM will set the related DTC at the end of the validation procedure.

The calibration procedure powers the seat track adjustments to the end of their travel, which is determined by the DSM sensing a change of state in the motor position sensors. If there is a concern with the seat track or motor position sensor that limits the travel, the DSM will interpret the stopping point as the end of travel and store the position. The DSM is not able to determine if the seat has moved to its FULL TRAVEL position. It is only capable of monitoring and storing the amount of travel seen by the position sensor changing states.

For additional information on carrying out the power seat calibration procedure, refer to the diagnostic tool operating manual.

Memory Seat

Memory seat positioning can be recalled with the memory switches on the driver door panel or a programmed remote keyless entry transmitter. In either case, the DSM receives a memory recall 1 or 2 command from the driver door module (DDM) over the SCP communication network. The memory recall switches are a hardwired input to the DDM. The DDM also receives the remote keyless entry transmitter signals. Once a valid memory recall command is received from the DDM, the DSM moves the driver seat to the position stored in memory by powering the appropriate motors and monitoring the motor position sensors until the position is reached.

This system allows automatic positioning of the driver seat to 2 programmable positions.

- To program position 1, move the driver seat to the desired position using the seat control switch. Depress the set button. Within 5 seconds, depress button 1.
- To program position 2, repeat the previous procedure using the set button and button 2.
- To recall position 1, depress button 1. To recall position 2, depress button 2.

A position can only be recalled when the transmission selector is in PARK or NEUTRAL. A position may be programmed at any time.

Easy Exit/Easy Entry

The easy exit function moves the seat backwards about 2 inches when the ignition key is removed from the ignition switch. The DSM receives a key out command over the SCP communication network and powers the driver seat rearward. This function will not operate if the seat is less than the travel distance to the end of the track, or the function has been deactivated at the message center driver personality settings. The DSM will also cancel this operation if a valid input command is received, such as the seat control switch or memory recall request.

The DSM will record the current seat position before powering the seat for an easy exit function. This recorded position will be used to return the seat to this position on the easy entry operation. During easy entry operation, the seat is returned to the position previous to the easy exit operation. Easy entry operation will be cancelled if a valid input command is received by the DSM.

Passenger Power Seat

The passenger power seat motors are hardwired to the passenger seat control switch. The circuits are normally at ground through the seat control switch. The individual circuit is switched to power when the specific adjustment position is selected.

Climate Controlled Seat System

NOTE: When installing a new climate control seat module (CCSM), it is necessary to carry out programmable module installation (PMI). For additional information, refer to Section 418-01 .

Both the driver and front passenger seat has an independent climate controlled seat system installed. A climate controlled seat module mounted to the bottom of the seat cushion electronically controls the climate controlled seat system (CCSM). The climate controlled seat system receives power from both the battery power and vehicle run circuits. The vehicle must have ignition ON and the dual automatic temperature control unit (DATC) module switch set to HEAT or COOL 1, 2, 3 or AUTO for the climate controlled seat system to activate.

AUTO mode is achieved by pressing the HEAT and COOL settings simultaneously. The center LED will be illuminated when the CCSM is in AUTO mode.

Cabin air is drawn through the seat fan motor and distributed to each of the thermo-electric device (TED) modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad B-surface. Channels in the A-surface of the foam pad are used to distribute the air along the surface of the seat.

Once the system is activated, the climate controlled seat module uses a set of flexible algorithms to control the heating/cooling modes, and the fan motor speed based on the climate controlled seat switch settings. These algorithms are designed to protect the user from potentially harmful prolonged exposure to climate extremes.

The TED uses a "Peltier" circuit of P-type and N-type semiconductors connected in series using copper electrical conductors. The semiconductors are sandwiched between 2 insulating ceramic plates. When current is applied to the TED, one side releases energy as heat, while the opposite side absorbs energy and gets cold. By reversing the current flow, the hot and cold sides reverse.

The temperature differences between the individual HEAT and COOL settings is minimal. For example, it is difficult to distinguish between LOW COOL and MEDIUM COOL settings. Monitoring the seat temperature at different HEAT or COOL settings should not be done as it is ineffective in confirming climate controlled seat system operation.

Heating Characteristics

NOTE: The presence of overtemp faults (DTCs B2729, B2730 and B2731) can be induced by incorrect operation of the climate controlled seat system after an initial HEAT setting has been attained. If a HEAT setting is repeatedly turned OFF and ON in an attempt to increase the seat temperature, an overtemp condition can result and the DTC(s) will be set.

- The climate controlled seat system draws approximately 7.5 amps until reaching the set point, and then the system draws approximately 2 amps to maintain the climate setting.

- In HEAT mode, the TED can add up to 40-60°C (72-108°F) to the ambient air temperature entering the system.
- There are 3 manual settings based on the position of the climate controlled seat switch on the DATC module. Position 1 is the LOW setting and position 3 is the HIGH setting.
- There are 5 AUTO HEAT settings. The AUTO HEAT setting is determined by the temperature setting of the DATC module when the CCSM is in AUTO HEAT mode.
- In the LOW setting, the climate controlled seat module is set to maintain TED temperature at 37°C (99°F).
- In the HIGH setting, the climate controlled seat module is set to maintain TED temperature at 65°C (149°F).
- If the temperature at 1 of the TEDs rises above 85°C (185°F) in the HEAT mode or 70°C (149°F) in the COOL mode for more than 4 seconds, the CCSM will record an overtemp DTC, remove power from the TEDs and go into BLOWER ONLY mode in an attempt to cool down the TEDs. If the TEDs temperature has not dropped to 80°C (176°F) in the HEAT mode or 65°C (140°F) in the COOL mode after 30 seconds, the CCSM will shut down and remain off until the ignition is cycled. Also if the CCSM detects an overtemp twice during the same ignition cycle, it will also shut down.
- In HEAT mode, there is no linear correlation between the (DATC) module, the seat fan motor speed and the TED supply voltage. The CCSM will independently vary the fan speed and the TED supply voltage in order to reach and maintain the temperature determined by the (DATC) module setting.

Cooling Characteristics

- The climate controlled seat system draws approximately 7 amps until reaching the set point, and then the system draws approximately 2 amps to maintain the temperature setting.
- In the COOL mode, the TED can remove up to 8-10°C (14-18°F) from the ambient air temperature entering the system.
- There are 3 manual settings based on the position of the climate controlled seat switch on the DATC module. Position 1 is the LOW setting and position 3 is the HIGH setting.
- If the temperature at 1 of the TEDs falls below 18°C (64°F), the climate controlled seat module will shut down the TEDs. If the temperature continues to drop below 12°C (54°F), the climate controlled seat module will shut down the fan motor.
- In COOL mode, there is a correlation between the DATC module, the seat fan motor speed and the TED supply voltage. Fan supply voltage is used in the following equation (seat fan motor supply voltage/0.74 x ignition voltage) to determine the fan duty cycle. For additional information, refer to the following chart.

Climate Controlled Seat Switch Setting [a]	Seat Fan Motor Supply Voltage	Thermo- Electric Device Supply Duty Cycle
0	Off	Off
MANUAL 1 or AUTO 1	8.7 volts	0%
AUTO Mode 2	9 volts	32%
MANUAL 2 or AUTO 3	9.1 volts	45%
AUTO Mode 4	9.1 volts	45%
MANUAL 3 or AUTO 5	9.5 volts	100%

[a] Auto settings are determined by the temperature settings of the DATC module and cannot be manually selected.

The climate controlled seat system is deactivated by one of the following actions:

- Setting the DATC module setting to manual OFF.
- Turning the vehicle off.

Rear Heated Seats

The left and right rear heated seats share a common battery and ignition feed. A separate shared ground source supplies the heated seat switches. When the heated seat switch is pressed with the ignition switch in RUN, a momentary ground signal is sent to the heated seat module. The heated seat module then supplies power to the heating element circuit. The cushion element and seat backrest element are wired in series and powered by the same output. The heated seat module will also provide voltage to the separate indicator circuit at the heated seat switch to indicate an ON state. The heated seat module will remain on until the heated seat switch is pressed and a momentary ground signal is received, or until 10 minutes expire. If the ignition source is removed from the module, the heated seat module will enter an OFF state and will not return to ON until the switch is once again pressed with the ignition switch in RUN. The heated seat module is designed to heat the seat to 37.5°C (99.5°F) and maintain the temperature until timed-out or switched off. This temperature is maintained by the heated seat module monitoring the temperature sensor located in the seat cushion element, and adjusting the current flow to the heating elements.

Inspection and Verification

1. Verify the customer concern by operating the system.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Front seat track motors • Front seat track binding or obstructed • Front seat backrest power recline • Lumbar motor • Climate controlled seat ducts	• Driver door module fuse(s): ♦ Central junction box (CJB) fuse 7 (5A) ♦ CJB fuse 22 (10A) • Driver seat module fuse(s): ♦ Battery junction box (BJB) fuse 21 (20A) ♦ CJB fuse 7 (5A) • Passenger power seat BJB fuse 28 (20A) • Rear heated seat fuse(s): ♦ BJB 11 (20A) ♦ CJB fuse 16 (5A) • Driver power lumbar BJB fuse 21 (20A) • Passenger power lumbar BJB fuse 28 (20A) • Driver and passenger climate controlled seat module fuse(s): ♦ BJB fuse 26 (30A) ♦ CJB fuse 16 (5A) • Seat control switch • Memory set switch • Lumbar seat control switch • Seat fan motor • Climate controlled seat module • Climate controlled seat switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel. Then select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.

6. Carry out the DATA LINK DIAGNOSTICS test. If the diagnostic tool responds with:
    - SCP+, SCP- or UBP circuit fault; ALL ECUS NO RESP/NOT EQUIP, refer to Section 418-00 .
    - NO RESP/NOT EQUIP for DSM, GO to Pinpoint Test A .
    - NO RESP/NOT EQUIP for DDM, GO to Pinpoint Test B .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the DSM and the DDM.

7. If the DTCs are retrieved go to the DSM Diagnostic Trouble Code (DTC) Index or the Climate Controlled Seat Module Diagnostic Trouble Code (DTC) Index.

8. If the DDM DTCs retrieved are related to the concern, go to the DDM Diagnostic Trouble Code (DTC) Index.

9. If no DTCs are retrieved, GO to Symptom Chart .

DSM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Is Faulted	DSM	REPEAT the DSM self-test. If DTC B1342 is retrieved again, INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1676	Battery Pack Voltage Out of Range	DSM	GO to Pinpoint Test R .
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	DSM	GO to Pinpoint Test G .
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	DSM	GO to Pinpoint Test G .
B1711	Seat Driver Front Up Switch Circuit Short to Battery	DSM	GO to Pinpoint Test G .
B1715	Seat Driver Front Down Switch Circuit Short to Battery	DSM	GO to Pinpoint Test G .
B1719	Seat Driver Forward Switch Circuit Short to Battery	DSM	GO to Pinpoint Test G .

B1723	Seat Driver Rearward Switch Circuit Short to Battery	DSM	GO to Pinpoint Test G .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	DSM	GO to Pinpoint Test G .
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	DSM	GO to Pinpoint Test G .
B1757	Seat Driver Rear Down Circuit Failure	DSM	GO to Pinpoint Test G .
B1761	Seat Driver Front Down Circuit Failure	DSM	GO to Pinpoint Test G .
B1765	Seat Driver Forward Circuit Failure	DSM	GO to Pinpoint Test G .
B1769	Seat Driver Backward Circuit Failure	DSM	GO to Pinpoint Test G .
B2143	NVM Memory Failure	DSM	CARRY OUT seat calibration of the DSM. CLEAR the DTCs. REPEAT the self-test. IF the DTC resets, INSTALL a new DSM. REFER to Section 419-10 . CARRY OUT seat calibration of the new DSM.
B2146	Seat Recline Motor Position Out of Range	DSM	GO to Pinpoint Test G .
B2149	Seat Front Vertical Motor Position Out of Range	DSM	GO to Pinpoint Test G .
B2152	Seat Rear Vertical Motor Position Out of Range	DSM	GO to Pinpoint Test G .
B2155	Seat Horizontal Motor Position Out of Range	DSM	GO to Pinpoint Test G .
B2158	Seat Recline Motor Memory Position Out of Range	DSM	GO to Pinpoint Test I .
B2161	Seat Front Vertical Motor Memory Position Out of Range	DSM	GO to Pinpoint Test I .
B2164	Seat Rear Vertical Motor Memory Position Out of Range	DSM	GO to Pinpoint Test I .
B2167	Seat Horizontal Motor Memory Position Out of Range	DSM	GO to Pinpoint Test I .

DDM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1309		DDM	REFER to Section 501-14 .

	Power Door Lock Circuit Short to Ground		
B1341	Power Door Unlock Circuit Short to Ground	DDM	REFER to Section 501-14 .
B1342	ECU Is Faulted	DDM	CLEAR the DTC. REPEAT the DDM self-test. If DTC B1342 is retrieved, INSTALL a new DDM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1400	Driver Power Window One Touch Window Relay Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1405	Driver Power Window Down Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1408	Driver Power Window Up Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1416	Power Window LR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1420	Passenger Power Window Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1424	Power Window RR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1530	Memory Set Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1676	Battery Pack Voltage Out of Range	DDM	REFER to Section 414-00 .
B2112	Door Driver Set Switch Stuck Failure	DDM	REFER to Section 501-14 .
B2116	Door Driver Reset Switch Stuck Failure	DDM	REFER to Section 501-14 .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2336	Mirror Switch Assembly Circuit Failure	DDM	REFER to Section 501-09 .
B2425	Remote Keyless Entry Out of Synchronization	DDM	REFER to Section 501-14 .
B2477	Module Configuration Failure	DDM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09 .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Climate Controlled Seat Module (CCSM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Is Faulted	CCSM	INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module .
B1358	Ignition Switch or Blower Electronics Circuit Short to Ground	CCSM	GO to Pinpoint Test S .
B2477	Module Configuration Error	CCSM	This DTC indicates programmable module installation (PMI) has not been done to a newly installed module. CARRY OUT PMI. REFER to Section 418-01 . CLEAR the DTC. CARRY OUT the self-test.
B2486	Climate Controlled Seat Module Voltage Out of Range	CCSM	Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . DISCONNECT driver seat side air bag C316 or passenger seat side air bag C314 of the affected seat and CONNECT restraint system diagnostic tool 418-133 or 501-097 to the seat side air bag module body harness connector. CONNECT the battery ground cable. CHECK circuit 20-HC21 (PK/BK) (driver) or circuit 20-HC22 (PK/YE) passenger for a fault and REPAIR as needed. If okay, REFER to Section 414-00 . Once the repair is complete, DISCONNECT the restraint system diagnostic tool from the seat side air bag module body harness connector and CONNECT the seat side air bag module connector of the affected seat. REPOWER the SRS. REFER to Section 501-20B .
B2488 [a]	Thumb-Wheel Switch Voltage Out of Range High	CCSM	**NOTE:** Make sure CCSM C3031b (driver) or CCSM C3036b (passenger) pins 7 and 15 are open (no connect). If circuits are present at either pin location, repair the wiring concern. CONFIGURE the CCSM. CLEAR the DTC. If the DTC does not clear, CONFIGURE the CCSM once again. CLEAR the DTC. If the DTC does not clear, INSTALL a new CCSM.
B2521	Tach Circuit Failure	CCSM	GO to Pinpoint Test S .
B2729	Cushion Over-Temp Detected	CCSM	For driver CCSM, GO to Pinpoint Test T . For passenger CCSM, GO to Pinpoint Test U .
B2730	Back Over-Temp Detected	CCSM	For driver CCSM, GO to Pinpoint Test T . For passenger CCSM, GO to Pinpoint Test U .
B2731	Differential Temperature Fault	CCSM	For driver CCSM, GO to Pinpoint Test T . For passenger CCSM, GO to Pinpoint Test U .
B2792 [a]	Heat Switch Short to Ground	CCSM	**NOTE:** Make sure CCSM C3031b (driver) or CCSM C3036b (passenger) pin 6 are open (no connect). If circuits are present at either pin location, repair the wiring concern. CONFIGURE the CCSM. CLEAR the DTC. If the DTC does not clear, CONFIGURE the CCSM once again. CLEAR the DTC. If the DTC does not clear, INSTALL a new CCSM.

B2793 [a]	Cool Switch Short to Ground	CCSM	**NOTE:** Make sure CCSM C3031b (driver) or CCSM C3036b (passenger) pin 16 is open (no connect). If circuit is present at either pin location, repair the wiring concern. CONFIGURE the CCSM. CLEAR the DTC. If the DTC does not clear, CONFIGURE the CCSM once again. CLEAR the DTC. If the DTC does not clear, INSTALL a new CCSM.
U2362	UBP Invalid Data Node ID	CCSM	REFER to Section 418-00 .

[a] The presence of this DTC indicates the module is not configured correctly.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: No Communication With The Driver Seat Module (DSM)

Normal Operation

The DSM is powered by battery voltage from circuit 29-AH80 (OG/WH) and 30-AH80 (RD) and is supplied ground on circuit 31-AH80 (BK) and 91-AH80 (BN/WH).

Possible Causes

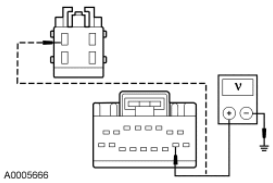
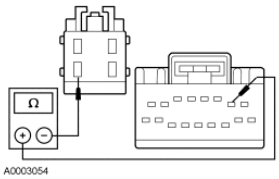
No communication with the driver seat module can be caused by:

- fuse(s).
- wiring, terminals or connectors.
- a faulty DSM.

PINPOINT TEST A: NO COMMUNICATION WITH THE DRIVER SEAT MODULE (DSM)

Test Step	Result / Action to Take
A1 CHECK DIAGNOSTIC TOOL COMMUNICATION TO THE DDM	
• Using the results from the DATA LINK DIAGNOSTICS test, check for communication to the DDM. • **Does the diagnostic tool communicate with the DDM?**	**Yes** GO to A2 . **No** GO to Pinpoint Test B .
A2 CHECK CIRCUITS 29-AH80 (OG/WH) AND 30-AH80 (RD) FOR VOLTAGE	

⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Disconnect: DSM C341b. • Disconnect: DSM C341c. • Measure the voltage between DSM C341c-10, circuit 29-AH80 (OG/WH), harness side and ground; and between DSM C341b-4, circuit 30-AH80 (RD), harness side and ground.	**Yes** GO to A3 . **No** VERIFY central junction box (CJB) fuse 7 (5A) and battery junction box (BJB) fuse 21 (20A) are OK. If OK, REPAIR the circuit in question. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

 A0005666 • **Are the voltages greater than 10 volts?**	
A3 CHECK CIRCUIT 31-AH80 (BK) AND 91-AH80 (BN/WH) FOR AN OPEN	
• Measure the resistance between DSM C341b-3, circuit 31-AH80 (BK), harness side and ground; and between DSM C341c-2, circuit 91-AH80 (BN/WH), harness side and ground.  A0003054 • **Are the resistances less than 5 ohms?**	**Yes** REFER to Section 418-00 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test B: No Communication With The Driver Door Module (DDM)

Normal Operation

The DDM is powered by battery voltage from circuits 29-AJ80 (OG) and ignition voltage circuit 29S-AJ86 (OG/BU) and is supplied ground on circuits 91-AJ80 (BN/BU) and 31-AJ80B (BK/OG).

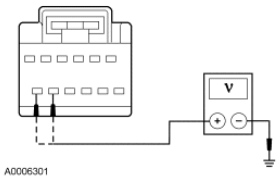
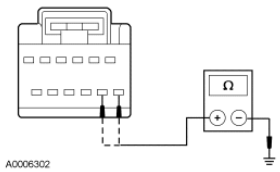
Possible Causes

No communication with driver door module can be caused by:

- fuse(s).
- wiring, terminals or connectors.
- a faulty DDM.

PINPOINT TEST B: NO COMMUNICATION WITH THE DRIVER DOOR MODULE (DDM)

Test Step	Result / Action to Take
B1 CHECK CIRCUITS 29-AJ80 (OG) AND 29S-AJ86 (OG/BU) FOR VOLTAGE	

• Ignition OFF. • Disconnect: DDM C501a. • Ignition ON. • Measure the voltage between DDM C501a-11, circuit 29-AJ80 (OG), harness side and ground; and between DDM C501a-12, circuit 29S-AJ86 (OG/BU), harness side and ground.  A0006301 • **Are the voltages greater than 10 volts?**	**Yes** GO to B2 . **No** VERIFY central junction box (CJB) fuse 7 (5A) and CJB fuse 22 (10A) are OK. If OK, REPAIR the circuit in question. Test the system for normal operation.
B2 CHECK CIRCUITS 31-AJ80B (BK/OG) AND 91-AJ80 (BN/BU) FOR OPENS	
• Ignition OFF. • Measure the resistance between DDM C501a-7, circuit 91-AJ80 (BN/BU), harness side and ground; and between DDM C501a-8, circuit 31-AJ80B (BK/OG), harness side and ground.  A0006302 • **Is the resistance less than 5 ohms?**	**Yes** REFER to Section 418-00 . **No** REPAIR the circuit(s) in question. Test the system for normal operation.

Pinpoint Test C: The Power Seat Is Inoperative — Passenger

Normal Operation

The power seat switch is powered by battery voltage to passenger seat control switch circuit 30-AH42 (RD) and is supplied ground on passenger circuits 31-AH42 (BK).

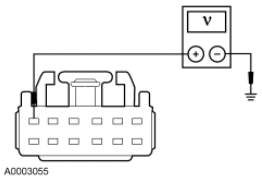
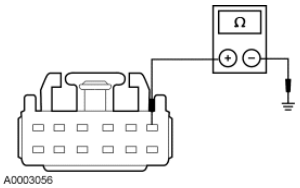
Possible Causes

An inoperative passenger power seat can be caused by:

- a fuse.
- wiring, terminals or connectors.
- a faulty power seat switch.
- a faulty power seat motor.

PINPOINT TEST C: THE POWER SEAT IS INOPERATIVE — PASSENGER

Test Step	Result / Action to Take
C1 CHECK FOR POWER TO THE PASSENGER SEAT CONTROL SWITCH	
⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Passenger Seat Side Air Bag Module C314. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Passenger Seat Side Air Bag Module C314. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Disconnect: Passenger Seat Control Switch C330. • Measure the voltage between passenger seat control switch C330-6, circuit 30-AH42 (RD), harness side	**Yes** GO to C2 . **No** VERIFY battery junction box (BJB) fuse 28 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

and ground.  • **Is the voltage greater than 10 volts?**	
C2 CHECK CIRCUIT 31-AH42 (BK) FOR AN OPEN	
• Measure the resistance between passenger seat control switch C330-1, circuit 31-AH42 (BK), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new passenger seat control switch. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test D: The Power Seat Moves But Is Noisy

Normal Operation

The power seat should move quietly during operation. Some noise is acceptable.

Possible Causes

A noisy power seat can be caused by:

- a misaligned seat track.
- a faulty seat track component.
- an object obstructing seat movement.

PINPOINT TEST D: THE POWER SEAT MOVES BUT IS NOISY

Test Step	Result / Action to Take
D1 CHECK THE TRACK ALIGNMENT	
	Yes ALIGN the track to the seat and the floor. TEST the

⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Ignition OFF. • Check the alignment of the track to the floor and the track to the seat. • **Is the track out of alignment?**	system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat track part. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test E: The Power Seat Moves But Is Loose

Normal Operation

The power seat movement should be smooth and the seat cushion should not rock during or after operation.

Possible Causes

A loose power seat can be caused by:

- loose fastening hardware.
- a faulty seat track component.

PINPOINT TEST E: THE POWER SEAT MOVES BUT IS LOOSE

Test Step	Result / Action to Take
E1 CHECK THE FASTENING HARDWARE	
⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver	**Yes** TIGHTEN all fastening hardware to specification. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** IDENTIFY the cause and INSTALL a new seat track component. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Ignition OFF. • **Is the fastening hardware loose?**	

Pinpoint Test F: The Power Seat Does Not Make Full Travel

Normal Operation

The driver power seat should travel fully horizontal (forward/rearward) and vertical (front up/down and rear up/down). The passenger power seat should travel fully horizontal (forward/rearward) and vertical (front up/down).

Possible Causes

A power seat that does not make full travel can be caused by:

- an obstruction.
- a faulty seat track component.

PINPOINT TEST F: THE POWER SEAT DOES NOT MAKE FULL TRAVEL

Test Step	Result / Action to Take
F1 CHECK FOR OBSTRUCTION IN THE SEAT TRACK	
⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system	**Yes** REMOVE the obstruction(s) and GREASE the track(s). TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** IDENTIFY the cause and INSTALL a new seat track component. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT

(SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Ignition OFF. • Remove the affected seat. Refer to Seat — Front in this section. • **Are there any obstructions in the track?**	driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test G: The Memory Seat Does Not Move Horizontally/Vertically/Recline — Driver

Normal Operation

The power seat switch is powered by battery voltage to driver seat control switch circuit 29-AH35 (OG/YE) and is supplied ground on driver circuit 91-AH35 (BN). When pressed, the power seat switch supplies the voltage and ground to the driver seat module (DSM). The DSM then supplies voltage and ground to the appropriate power seat track motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the power seat switch reverses the polarity to the DSM, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/reverse) and vertically (front up/down and rear up/down). The power recliner cannot be repaired separately. If the power recliner needs to be repaired, an entirely new front seat backrest frame must be installed.

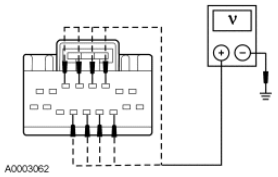
Possible Causes

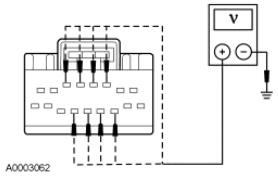
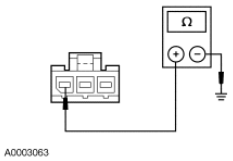
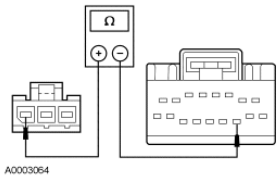
A memory seat that does not move horizontally/vertically can be caused by:

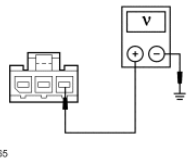
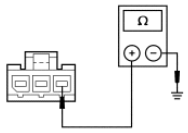
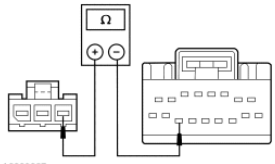
- a fuse.
- wiring, terminals or connectors.
- a faulty memory set switch.
- a faulty power seat track motor position sensor.
- a faulty DSM.

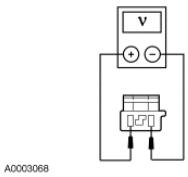
PINPOINT TEST G: THE MEMORY SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY/RECLINE — DRIVER

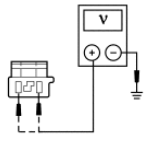
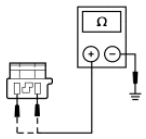
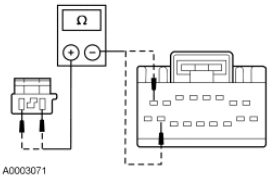
Test Step	Result / Action to Take
G1 RETRIEVE THE RECORDED DSM DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF TESTS	
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards. **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316. • Connect: Battery Ground Cable. • **⚠ WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Use the results recorded from the DSM continuous and on-demand self tests. • **Are any DSM DTCs recorded?**	**Yes** If DTC B1703, B1707, B1711, B1715, B1719, B1723, B1727 or B1731 was retrieved, GO to G2 . If any combination of DTC B1757, B1761, B1765, B1769, B2146, B2149, B2152 or B2155 are retrieved, GO to G4 . If only a combination of DTC B2146, B2149, B2152 or B2155 are retrieved, GO to G43 . **No** GO to G45 .
G2 CHECK FOR A SHORT TO BATTERY	

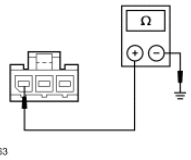
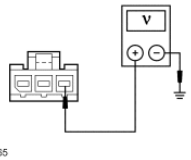
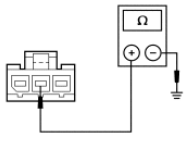
• Disconnect: DSM C341c. • Ignition ON. • Using the following table, measure the voltage between DSM C341c pins, harness side and ground. **DSM Connector-Pin / Circuit** C341c-3 — 10-AH83 (GY/OG) C341c-4 — 10-AH82 (GY/RD) C341c-5 — 8-AH84 (WH/BK) C341c-6 — 10-AH85 (GY/WH) C341c-11 — 8-AH83 (WH/GN) C341c-12 — 8-AH82 (WH/RD) C341c-13 — 10-AH84 (GY/BK) C341c-14 — 8-AH85 (WH/VT)  • **Are any of the voltages greater than 10 volts?**	**Yes** GO to G3 . **No** CLEAR the DSM DTCs. REPEAT the DSM self-test. If DTC B1703, B1707, B1711, B1715, B1719, B1723, B1727 or B1731 is retrieved, INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . If any other DTCs are retrieved, refer to the DSM Diagnostic Trouble Code (DTC) Index.
G3 CHECK THE DRIVER SEAT CONTROL SWITCH FOR A SHORT TO BATTERY	
• Ignition OFF. • Disconnect: Driver Seat Control Switch C360. • Ignition ON. • Using the following table, measure the voltage between DSM C341c pins, harness side and ground. **DSM Connector-Pin / Circuit** C341c-3 — 10-AH83 (GY/OG) C341c-4 — 10-AH82 (GY/RD) C341c-5 — 8-AH84 (WH/BK) C341c-6 — 10-AH85 (GY/WH) C341c-11 — 8-AH83 (WH/GN) C341c-12 — 8-AH82 (WH/RD) C341c-13 — 10-AH84 (GY/BK) C341c-14 — 8-AH85 (WH/VT)	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the DSM self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new driver seat control switch. CLEAR the DTCs. REPEAT the DSM self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the

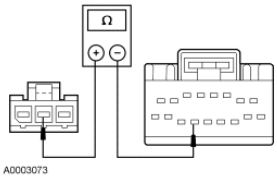
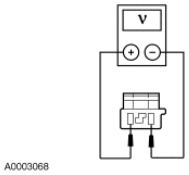
 A0003062 • **Are any of the voltages greater than 10 volts?**	supplemental restraint system (SRS). REFER to Section 501-20B .
G4 CHECK FOR MULTIPLE DSM DTCs	
• Use the results recorded from the DSM continuous and on-demand self tests. • **Are the DSM DTCs B1757, B1761 and B1765 all retrieved?**	**Yes** GO to G5 . **No** GO to G10 .
G5 CHECK THE HORIZONTAL POSITION SENSOR COMMON RETURN	
• Ignition OFF. • Disconnect: Horizontal Position Sensor C372. • Measure the resistance between horizontal position sensor C372-1, circuit 9-AH26 (BN/RD), harness side and ground.  A0003063 • **Is the resistance less than 180 ohms?**	**Yes** GO to G7 . **No** GO to G6 .
G6 CHECK CIRCUIT 9-AH26 (BN/RD) FOR AN OPEN	
• Disconnect: DSM C341a. • Measure the resistance between horizontal position sensor C372-1, circuit 9-AH26 (BN/RD), harness side and DSM C341a-11, circuit 9-AH80 (BN/WH), harness side.  A0003064 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the

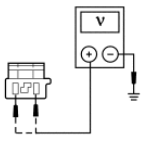
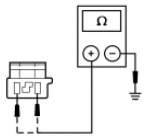
	restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G7 CHECK THE POSITION SENSOR COMMON FEED	
• Measure the voltage between horizontal position sensor C372-3, circuit 7-AH26 (YE/RD), harness side and ground.  A0003065 • **Is the voltage greater than 10 volts?**	**Yes** GO to G10 . **No** GO to G8 .
G8 CHECK CIRCUIT 7-AH26 (YE/RD) FOR A SHORT TO GROUND	
• Disconnect: DSM C341a. • Measure the resistance between horizontal position sensor C372-3, circuit 7-AH26 (YE/RD), harness side and ground.  A0003066 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G9 CHECK CIRCUIT 7-AH26 (YE/RD) OR 7-AH80 (YE/VT) FOR AN OPEN	
• Measure the resistance between horizontal position sensor C372-3, circuit 7-AH26 (YE/RD), harness side and DSM C341a-15, circuit 7-AH80 (YE/VT), harness side.  A0003067 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

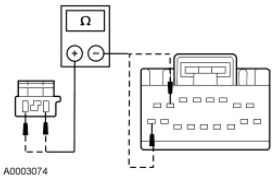
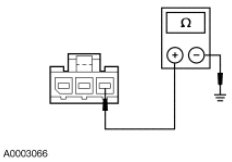
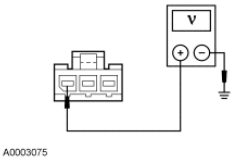
	No REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G10 CHECK FOR SINGLE DTCs	
• Ignition OFF. • Use the recorded results from the DSM self-test. • **Was DTC B1757, B1761, B1765 or B1769 retrieved?**	**Yes** For DTC B1757, GO to G11 . For DTC B1761, GO to G19 . For DTC B1765, GO to G27 . For DTC B1769, GO to G35 . **No** GO to G43 .
G11 CHECK VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR	
• Disconnect: Driver Seat Rear Height Motor C363. • Measure the voltage between driver seat rear height motor C363-1, circuit 33-AH41 (YE/VT), harness side and driver seat rear height motor C363-2, circuit 32-AH41 (WH/VT), harness side.  A0003068 • Operate the driver seat control switch to the REAR UP and REAR DOWN position. • **Is the voltage greater than 10 volts in both directions?**	**Yes** GO to G15 . **No** GO to G12 .
G12 CHECK THE DSM DRIVER SIDE REAR HEIGHT MOTOR CONTROL	
• Measure the voltage between driver seat rear height motor C363-1, circuit 33-AH41 (YE/VT), harness side and ground while operating the driver seat control switch to the REAR DOWN position; and between driver seat rear height motor C363-2, circuit 32-AH41 (WH/VT), harness side and ground while operating the driver seat control	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint

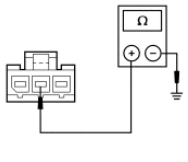
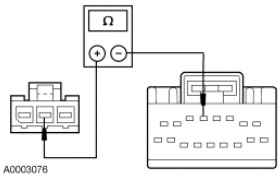
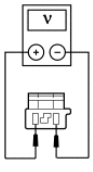
switch to the REAR UP position.  A0003069 • **Is the voltage greater than 10 volts in both directions?**	system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to G13 .
G13 CHECK CIRCUIT 33-AH41 (YE/VT) AND 32-AH41 (WH/VT) FOR A SHORT TO GROUND	
• Disconnect: DSM C341a. • Measure the resistance between driver seat rear height motor C363-1, circuit 33-AH41 (YE/VT), harness side and ground; and between driver seat rear height motor C363-2, circuit 32-AH41 (WH/VT), harness side and ground.  A0003070 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to G14 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G14 CHECK CIRCUIT 33-AH41 (YE/VT) AND 32-AH41 (WH/VT) FOR AN OPEN	
• Measure the resistance between driver seat rear height motor C363-1, circuit 33-AH41 (YE/VT), harness side and DSM C341a-8, circuit 33-AH41 (YE/VT), harness side; and between driver seat rear height motor C363-2, circuit 32-AH41 (WH/VT), harness side and DSM C341a-16, circuit 32-AH41 (WH/VT), harness side.  A0003071 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the DSM self-test. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver

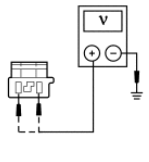
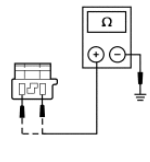
	seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G15 CHECK CIRCUIT 9-AH25 (BN/GN) FOR AN OPEN	
• Disconnect: Rear Height Motor Position Sensor C373. • Measure the resistance between rear height motor position sensor C373-1, circuit 9-AH25 (BN/GN), harness side and ground.  A0003063 • **Is the resistance less than 5 ohms?**	**Yes** GO to G16 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G16 CHECK CIRCUIT 7-AH25 (YE/GN) FOR AN OPEN	
• Measure the voltage between rear height motor position sensor C373-3, circuit 7-AH25 (YE/GN), harness side and ground.  A0003065 • **Is the voltage approximately 5 volts?**	**Yes** GO to G17 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G17 CHECK CIRCUIT 8-AH25 (WH/GN) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: DSM C341a. • Measure the resistance between rear height motor position sensor C373-2, circuit 8-AH25 (WH/GN), harness side and ground.  A0003072 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G18 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

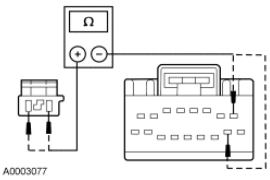
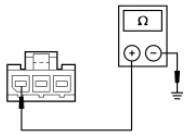
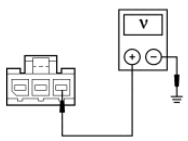
G18 CHECK CIRCUIT 8-AH25 (WH/GN) FOR AN OPEN	
• Measure the resistance between rear height motor position sensor C373-2, circuit 8-AH25 (WH/GN), harness side and DSM C341a-14, circuit 8-AH25 (WH/GN), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new seat track. CALIBRATE the driver seat. REFER to Principles of Operation. REPEAT the DSM self-test. If DTC B1757 is retrieved, INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self- test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G19 CHECK THE DRIVER SEAT FRONT HEIGHT MOTOR SUPPLY	
• Disconnect: Driver Seat Front Height Motor C382. • Measure the voltage between driver seat front height motor C382-2, circuit 33-AH38 (YE/BK), harness side and driver seat front height motor C382-1, circuit 32-AH38 (WH/BK), harness side.  • Operate the driver seat control switch to the FRONT UP and FRONT DOWN position. • **Is the voltage greater than 10 volts in both directions?**	**Yes** GO to G23 . **No** GO to G20 .
G20 CHECK THE DSM DRIVER SEAT FRONT HEIGHT MOTOR CONTROL	

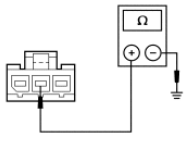
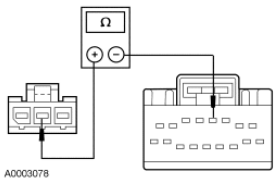
• Measure the voltage between driver seat front height motor C382-2, circuit 33-AH38 (YE/BK), harness side and ground while operating the driver seat control switch to the FRONT DOWN position; and between driver seat front height motor C382-1, circuit 32-AH38 (WH/BK), harness side and ground, while operating the driver seat control switch to the FRONT UP position.  A0003069 • **Is the voltage greater than 10 volts in both directions?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to G21 .
G21 CHECK CIRCUIT 33-AH38 (YE/BK) AND 32-AH38 (WH/BK) FOR A SHORT TO GROUND	
• Disconnect: DSM C341a. • Measure the resistance between driver seat front height motor C382-2, circuit 33-AH38 (YE/BK), harness side and ground; and between driver seat front height motor C382-1, circuit 32-AH38 (WH/BK), harness side and ground.  A0003070 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to G22 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G22 CHECK CIRCUIT 33-AH38 (YE/BK) AND 32-AH38 (WH/BK) FOR AN OPEN	
• Measure the resistance between driver seat front height motor C382-2, circuit 33-AH38 (YE/BK), harness side and DSM C341a-7, circuit 33-AH38 (YE/BK), harness side; and between driver seat front height motor C382-1, circuit 32-AH38 (WH/BK), harness side and DSM C341a-17, circuit 32-AH38 (WH/BK), harness side.	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No**

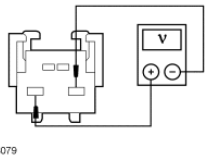
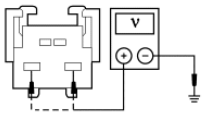
 A0003074 • **Are the resistances less than 5 ohms?**	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G23 CHECK CIRCUIT 9-AH24 (BN/YE) FOR AN OPEN	
• Disconnect: Front Height Motor Position Sensor C383. • Measure the resistance between front height motor position sensor C383-3, circuit 9-AH24 (BN/YE), harness side and ground.  A0003066 • **Is the resistance less than 5 ohms?**	**Yes** GO to G24 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G24 CHECK CIRCUIT 7-AH24 (YE/BK) FOR AN OPEN	
• Measure the voltage between front height motor position sensor C383-1, circuit 7-AH24 (YE/BK), harness side and ground.  A0003075 • **Is the voltage approximately 5 volts?**	**Yes** GO to G25 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G25 CHECK CIRCUIT 8-AH24 (WH/BK) FOR A SHORT TO GROUND	
• Disconnect: DSM C341a. • Measure the resistance between front height motor position sensor C383-2, circuit 8-AH24 (WH/BK), harness side and ground.	**Yes** GO to G26 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver

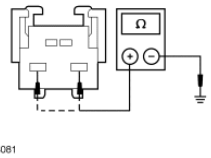
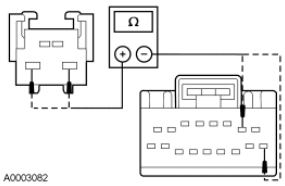
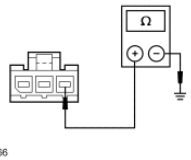
 A0003072 • **Is the resistance greater than 10,000 ohms?**	seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G26 CHECK CIRCUIT 8-AH24 (WH/BK) FOR AN OPEN	
• Measure the resistance between front height motor position sensor C383-2, circuit 8-AH24 (WH/BK), harness side and DSM C341a-5, circuit 8-AH24 (WH/BK), harness side.  A0003076 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new seat track. CALIBRATE the driver seat. REFER to Principles of Operation. REPEAT the self-test. If DTC B1761 is retrieved, INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G27 CHECK THE VOLTAGE TO THE DRIVER SEAT FORWARD/REARWARD MOTOR	
• Disconnect: Driver Seat Forward/Rearward Motor C362. • Measure the voltage between driver side forward/rearward motor C362-1, circuit 33-AH37 (YE/GN), harness side and driver side forward/rearward motor C362-2, circuit 32-AH37 (WH/GN), harness side.  A0003068	**Yes** GO to G31 . **No** GO to G28 .

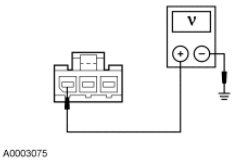
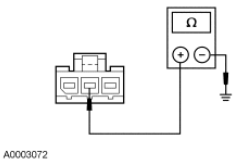
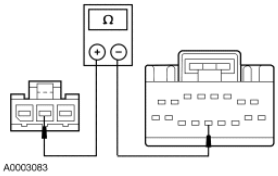
• Operate the driver seat control switch to the FORWARD and REARWARD position. • **Is the voltage greater than 10 volts in both directions?**	
G28 CHECK THE DSM FORWARD/REARWARD MOTOR CONTROL	
• Measure the voltage between driver side forward/rearward motor C362-1, circuit 33-AH37 (YE/GN), harness side and ground while operating the driver seat control switch to the REARWARD position; and between driver side forward/rearward motor C362-2, circuit 32-AH37 (WH/GN), harness side and ground while operating the driver seat control switch to the FORWARD position.  A0003069 • **Is the voltage greater than 10 volts in both directions?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to G29 .
G29 CHECK CIRCUIT 33-AH37 (WH/GN) AND 32-AH37 (YE/GN) FOR A SHORT TO GROUND	
• Disconnect: DSM C341. • Measure the resistance between driver side forward/rearward motor C362-1, circuit 33-AH37 (YE/GN), harness side and ground; and between driver side forward/rearward motor C362-2, circuit 32-AH37 (WH/GN), harness side and ground.  A0003070 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to G30 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G30 CHECK CIRCUIT 33-AH37 (YE/GN) AND 32-AH37 (WH/GN) FOR AN OPEN	
• Measure the resistance between driver side forward/rearward motor C362-1, circuit 33-AH37 (YE/GN), harness side and DSM C341a-1, circuit 33-AH37 (YE/GN), harness side; and between driver side forward/rearward motor C362-2, circuit 32-AH37 (WH/GN), harness side and DSM	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery

C341a-10, circuit 32-AH9 (WH/GN), harness side.  A0003077 • **Are the resistances less than 5 ohms?**	ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G31 CHECK CIRCUIT 9-AH26 (BN/RD) FOR AN OPEN	
• Disconnect: Forward/Rearward Motor Position Sensor C372. • Measure the resistance between FORWARD/REARWARD motor position sensor C372-1, circuit 9-AH26 (BN/RD), harness side and ground.  A0003063 • **Is the resistance less than 5 ohms?**	**Yes** GO to G32 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G32 CHECK CIRCUIT 7-AH26 (YE/RD) FOR AN OPEN	
• Measure the voltage between FORWARD/REARWARD motor position sensor C372-3, circuit 7-AH26 (YE/RD), harness side and ground.  A0003065 • **Is the voltage approximately 5 volts?**	**Yes** GO to G33 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the DSM self-test. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

G33 CHECK CIRCUIT 8-AH26 (WH/RD) FOR A SHORT TO GROUND	
• Disconnect: DSM C341a. • Measure the resistance between FORWARD/REARWARD motor position sensor C372-2, circuit 8-AH26 (WH/RD), harness side and ground.  A0003072 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G34 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G34 CHECK CIRCUIT 8-AH26 (WH/RD) FOR AN OPEN	
• Measure the resistance between FORWARD/REARWARD motor position sensor C372-2, circuit 8-AH26 (WH/RD), harness side and DSM C341a-4, circuit 8-AH26 (WH/RD), harness side.  A0003078 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new seat track. CALIBRATE the driver seat. REFER to Principles of Operation. REPEAT the DSM self-test. If DTC B1765 is retrieved, INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G35 CHECK THE DRIVER SEAT BACKREST MOTOR SUPPLY	

• Disconnect: Driver Seat Backrest Motor C368. • Measure the voltage between driver seat backrest motor C368-2, circuit 33-AH36 (YE/RD), harness side and driver seat backrest motor C368-1, circuit 32-AH36 (WH/RD), harness side, while operating the driver seat control switch to the RECLINE FORWARD and RECLINE REARWARD position.  A0003079 • **Is the voltage greater than 10 volts in both directions?**	**Yes** GO to G39 . **No** GO to G36 .
G36 CHECK THE DSM BACKREST MOTOR CONTROL	
• Measure the voltage between driver seat backrest motor C368-2, circuit 33-AH36 (YE/RD), harness side and ground while operating the driver seat control switch to the BACKREST FORWARD position; and between driver seat backrest motor C368-1, circuit 32-AH36 (WH/RD), harness side and ground while operating the driver seat control switch to the BACKREST REARWARD position.  A0003080 • **Is the voltage greater than 10 volts in both directions?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to G37 .
G37 CHECK CIRCUIT 33-AH36 (YE/RD) AND 32-AH36 (WH/RD) FOR A SHORT TO GROUND	
• Disconnect: DSM C341a. • Measure the resistance between driver seat backrest motor C368-2, circuit 33-AH36 (YE/RD), harness side and ground; and between driver seat backrest motor C368-1, circuit 32-AH34 (WH/RD), harness side and ground.	**Yes** GO to G38 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint

 A0003081 • **Are the resistances greater than 10,000 ohms?**	system (SRS). REFER to Section 501-20B .
G38 CHECK CIRCUIT 33-AH36 (YE/RD) AND 32-AH36 (WH/RD) FOR AN OPEN	
• Measure the resistance between driver seat backrest motor C368-2, circuit 33-AH36 (YE/RD), harness side and DSM C341a-9, circuit 33-AH36 (YE/RD), harness side; and between driver seat backrest motor C368-1, circuit 32-AH36 (WH/RD), harness side and DSM C341a-2, circuit 32-AH36 (WH/RD), harness side.  A0003082 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G39 CHECK CIRCUIT 9-AH30 (BN/BU) FOR AN OPEN	
• Disconnect: Backrest Motor Position Sensor C376. • Measure the resistance between backrest motor position sensor C376-3, circuit 9-AH30 (BN/BU), harness side and ground.  A0003066 • **Is the resistance less than 5 ohms?**	**Yes** GO to G40 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G40 CHECK CIRCUIT 7-AH30 (YE/BU) FOR AN OPEN	

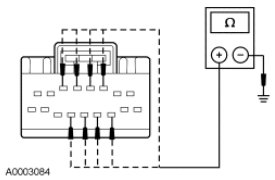
• Measure the voltage between backrest motor position sensor C376-1, circuit 7-AH30 (YE/BU), harness side and ground.  A0003075 • **Is the voltage approximately 5 volts?**	**Yes** GO to G41 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G41 CHECK CIRCUIT 8-AH30 (WH/BU) FOR A SHORT TO GROUND	
• Disconnect: DSM C341a. • Measure the resistance between backrest motor position sensor C376-2, circuit 8-AH30 (WH/BU), harness side and ground.  A0003072 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G42 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G42 CHECK CIRCUIT 8-AH30 (WH/BU) FOR AN OPEN	
• Measure the resistance between backrest motor position sensor C376-2, circuit 8-AH30 (WH/BU), harness side and DSM C341a-13, circuit 8-AH30 (WH/BU), harness side.  A0003083 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new seat backrest frame assembly. CALIBRATE the driver seat. REFER to Principles of Operation. REPEAT the DSM self-test. If DTC B1769 is retrieved, INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the

	battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G43 CHECK FOR HESITATION OR JOGGING	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear all DSM DTCs. • Enter the following diagnostic mode on the scan tool: Clear all DSM DTCs. • Enter the following diagnostic mode on the scan tool: Operate the driver seat control switch through all positions while monitoring DSM PIDs DRIVER SEAT HORIZONTAL POSITION, DRIVER SEAT FRONT VERTICAL POSITION, DRIVER SEAT REAR VERTICAL POSITION and DRIVER SEAT RECLINE POSITION while watching seat movement. • **Did the driver seat stop or hesitate, or did any of the DSM PIDs read inconsistently?**	**Yes** INSTALL a new seat track. CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to G44 .
G44 CHECK FOR AN INTERMITTENT CONCERN	
• Enter the following diagnostic mode on the scan tool: Clear all DSM DTCs. • Operate the driver power seat. Wiggle the harness and connectors. Inspect for any visual concerns. • Enter the following diagnostic mode on the scan tool: DSM Self-Test. • **Were any DTCs retrieved?**	**Yes** If DTC B2146, B2149, B2152 or B2155 is retrieved, INSTALL a new seat track. CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
G45 CHECK THE DRIVER SEAT CONTROL SWITCH PIDs	

<table>
<tr><td>
• Enter the following diagnostic mode on the scan tool: Operate the driver seat control seat switch through all positions while monitoring the DDM PIDs DRIVER SEAT INPUT SWITCH STATUS.
• Do the DDM PIDs accurately represent the seat control switch positions?
</td><td>
Yes
INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

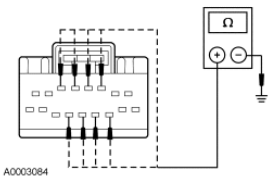
No
GO to G46 .
</td></tr>
<tr><td colspan="2">G46 CHECK THE DRIVER SEAT CONTROL SWITCH CIRCUITS FOR AN OPEN</td></tr>
<tr><td>
• Ignition OFF.
• Disconnect: DSM C341c.
• Using the following table, measure the resistance between DSM C341c pins, harness side and ground.

<table>
<tr><th>DSM Connector-Pin</th><th>Circuit</th></tr>
<tr><td>C341c-3</td><td>10-AH83 (GY/OG)</td></tr>
<tr><td>C341c-4</td><td>10-AH82 (GY/RD)</td></tr>
<tr><td>C341c-5</td><td>8-AH84 (WH/BK)</td></tr>
<tr><td>C341c-6</td><td>10-AH85 (GY/WH)</td></tr>
<tr><td>C341c-11</td><td>8-AH83 (WH/GN)</td></tr>
<tr><td>C341c-12</td><td>8-AH82 (WH/RD)</td></tr>
<tr><td>C341c-13</td><td>10-AH84 (GY/BK)</td></tr>
<tr><td>C341c-14</td><td>8-AH85 (WH/VT)</td></tr>
</table>



• Are the resistances less than 5 ohms?
</td><td>
Yes
GO to G47 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
</td></tr>
<tr><td colspan="2">G47 CHECK THE DRIVER SEAT CONTROL SWITCH CIRCUITS FOR A SHORT TO GROUND</td></tr>
</table>

• Disconnect: Driver Seat Control Switch C360. • Using the following table, measure the resistance between DSM C341c pins, harness side and ground. **DSM Connector-Pin / Circuit** C341c-3 — 10-AH83 (GY/OG) C341c-4 — 10-AH82 (GY/RD) C341c-5 — 8-AH84 (WH/BK) C341c-6 — 10-AH85 (GY/WH) C341c-11 — 8-AH83 (WH/GN) C341c-12 — 8-AH82 (WH/RD) C341c-13 — 10-AH84 (GY/BK) C341c-14 — 8-AH85 (WH/VT)  A0003084 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat control switch. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test H: The Power Seat Does Not Move Horizontally/Vertically — Passenger

Normal Operation

The power seat switch is powered by battery voltage on circuit 30-AH42 (RD) and is supplied ground on circuit 31-AH42 (BK). When pressed, the power seat switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the power seat switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 2 power seat track motors that combine to move the seat horizontally (forward/reverse) and vertically (front up/down).

Possible Causes

A power seat that does not move horizontally and/or vertically can be caused by:

- wiring, terminals or connectors.
- a faulty seat control switch.
- a faulty seat track motor.

PINPOINT TEST H: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY — PASSENGER

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>H1 CHECK THE PASSENGER SEAT MOTOR OPERATION</td><td></td></tr>
<tr><td>
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, the SRS must be depowered. Refer to Section 501-20B .

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

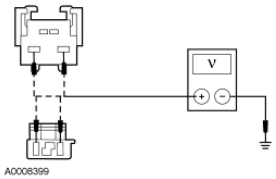
• Ignition OFF.
• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
• Disconnect: Passenger Seat Side Air Bag Module C314.
• Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Passenger Seat Side Air Bag Module C314.
• Connect: Battery Ground Cable.
• ⚠ WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.
• Disconnect the passenger seat motor connector in question (forward/rearward motor C332, seat height motor C333 or seat backrest motor C338).
• Using the following table, measure the voltage between the inoperative passenger seat motor connector, harness side and ground, while moving the seat control switch in the indicated direction:

<table>
<tr><th>Motor</th><th>Connnector-Pin</th><th>Circuit</th><th>Direction of Control Switch</th></tr>
<tr><td>Forward/

Reverse</td><td>C332-2</td><td>32-AH44 (WH/GN)</td><td>Forward</td></tr>
</table>
</td><td>
Yes
INSTALL a new passenger seat track or the backrest frame assembly. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

No
GO to H2 .
</td></tr>
</table>

Motor			
Forward/ Reverse Motor	C332-1	33-AH44 (YE/GN)	Reverse
Height Motor	C333-1	32-AH34 (WH/BK)	Up
Height Motor	C333-2	33-AH34 (YE/BK)	Down
Backrest Motor	C338-1	32-AH43 (WH/RD)	Tilt Up
Backrest Motor	C338-2	33-AH43 (YE/RD)	Tilt Down



- **Are the voltages greater than 10 volts in the inoperative directions?**

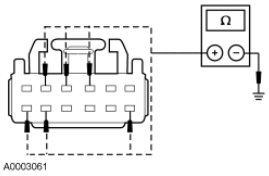
H2 CHECK THE PASSENGER SEAT MOTOR CIRCUITS FOR A SHORT TO GROUND

- Disconnect: Passenger Seat Control Switch C330.
- Using the following table, measure the resistance between passenger seat control switch C330 pins, harness side and ground:

Connector- Pin	Circuit	Inoperative Motor
C330-12	32-AH43 (WH/RD)	Backrest
C330-7	33-AH43 (YE/RD)	Backrest
C330-4	32-AH34 (WH/BK)	Height
C330-5	33-AH34 (YE/BK)	Height
C330-3	32-AH44 (WH/GN)	Forward/ Rearward
C330-11	33-AH44 (YE/GN)	Forward/ Rearward

Yes
GO to H3 .

No
REPAIR the circuit in question. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

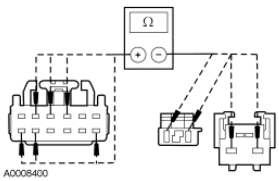


- **Are the resistances greater than 10,000 ohms?**

H3 CHECK FOR AN OPEN CIRCUIT

- Ignition OFF.
- Measure the resistance between passenger seat control switch C330 pins, harness side and the inoperative motor connector, harness side:

Switch Connector-Pin	Circuit	Motor Connector-Pin
Height Motor		
C330-4	32-AH34 (WH/BK)	C333-1
C330-5	33-AH34 (YE/BK)	C333-2
Forward/Reverse Motor		
C330-3	32-AH44 (WH/GN)	C332-2
C330-11	33-AH44 (YE/GN)	C332-1
Backrest Motor		
C330-12	32-AH43 (WH/RD)	C338-1
C330-7	33-AH43 (YE/RD)	C338-2



- **Are all resistance readings less than 5 ohms?**

Yes
INSTALL a new passenger seat control switch. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

No
REPAIR the circuit in question. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test I: The Memory Seat Is Inoperative

Normal Operation

The power seat switch is powered by battery voltage to driver seat control switch circuit 29-AH35 (OG/YE) and is supplied ground on driver circuit 91-AH35 (BN). When pressed, the power seat switch supplies the

voltage and ground to the driver seat module (DSM). The DSM then supplies voltage and ground to the appropriate power seat track motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the power seat switch reverses the polarity to the DSM, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/reverse) and vertically (front up/down and rear up/down).

Each power seat track motor includes a position sensor, which is a potentiometer. The DSM supplies a shared reference voltage and ground to each position sensor. This enables the position sensor to send a variable voltage back to the DSM to indicate the position of the power seat track motor. The DSM uses this information to return the seat to a stored preprogrammed position when pressing the memory set switch or a remote transmitter. Refer to Principles of Operation in this section and the owner's literature for additional information on programming the DSM for storing memory seat and adjustable pedal positions.

Possible Causes

An inoperative memory seat can be caused by:

- a fuse.
- wiring, terminals or connectors.
- a faulty seat control switch.
- a faulty power seat track motor.
- a faulty DSM.

PINPOINT TEST I: THE MEMORY SEAT IS INOPERATIVE

Test Step	Result / Action to Take
I1 CHECK THE MEMORY MIRROR OPERATION	
⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before	**Yes** GO to I2 . **No** REFER to Section 501-09 .

releasing the vehicle to the customer. • Carry out a memory recall for the exterior rear view mirrors. • **Did the memory mirrors operate correctly?**	
I2 CHECK THE DTCS FROM THE DSM	
• Use the recorded results from DSM self-test. • **Was DSM DTC B1342 retrieved?**	**Yes** CLEAR the DSM DTCs. REPEAT the DSM self-test. If DTC B1342 is retrieved, INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to I3 .
I3 CHECK THE POWER SEAT CALIBRATION	
• Enter the following diagnostic mode on the scan tool: CLEAR DSM DTCs. • Calibrate the driver seat. Refer to Seat Calibration in Principles of Operation. • **Were any DSM DTCs retrieved from calibration?**	**Yes** REFER to the DSM Diagnostic Trouble Code (DTC) Index. **No** GO to I4 .
I4 CHECK THE MEMORY RECALL OPERATION	
• Set a new memory seat position for driver 1 and driver 2. • Activate the memory recall for driver position 1 and driver position 2 from the memory set switch. • **Do the memory recall functions operate correctly?**	**Yes** The driver power seat is operating correctly. REVERIFY symptom. **No** INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. GO to I5 .
I5 CHECK THE MEMORY RECALL OPERATION	
• Set a new memory seat position for driver 1 and driver 2. • Activate the memory recall for driver position 1 and driver position 2 from the memory set switch.	**Yes** The driver power seat is operating correctly. REVERIFY symptom. **No** CHECK the DDM for any memory function related DTCs.

• **Do the memory recall functions operate correctly?**	REPAIR as necessary. REFER to the DDM Diagnostic Trouble Code (DTC) Index. CHECK for any DSM DTCs. REPAIR as necessary. REFER to the DSM Diagnostic Trouble Code (DTC) Index. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test J: The Left Rear Heated Seat Is Inoperative

Normal Operation

The left rear heated seat module is powered by battery voltage on circuit 30-HC21 (RD/GN) and by ignition voltage circuit 20-HC21D (PK/BK), and is supplied ground on circuit 31-HC21 (BK). The heated seat switch has a high and low setting depending on selection. The heated seat switch uses the ground on circuit 31-HC15 (BK/YE) to provide a ground input to the heated seat module on circuit 8-HC21 (WH/GN) (high setting) or 10-HC21 (GY/OG) (low setting). The heated seat module supplies voltage to the heated seat elements in the seat cushion and the seat back.

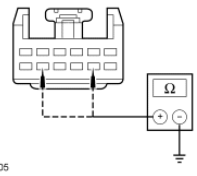
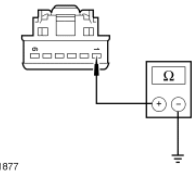
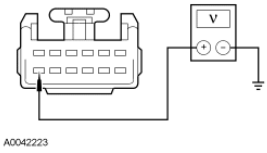
Possible Causes

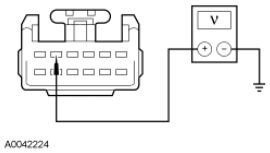
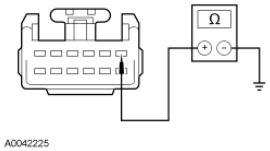
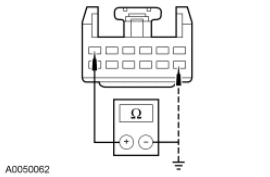
An inoperative heated seat can be caused by:

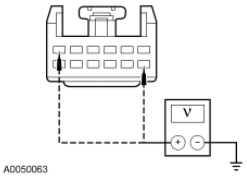
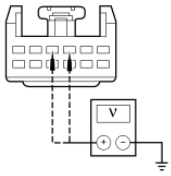
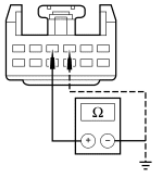
- fuse(s).
- wiring, terminals or connectors.
- a faulty heated seat switch.
- a faulty heated seat module.
- a faulty heated seat element.
- a faulty heated seat temperature sensor.

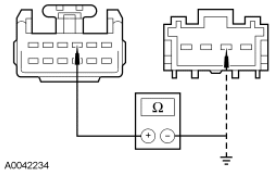
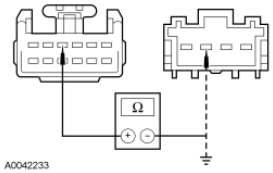
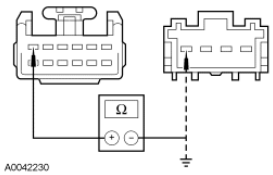
PINPOINT TEST J: THE LEFT REAR HEATED SEAT IS INOPERATIVE

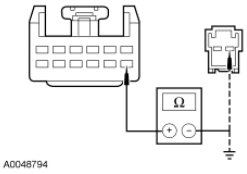
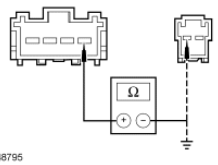
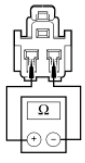
Test Step	Result / Action to Take
J1 CHECK THE HEATED SEAT SWITCH INPUT TO THE HEATED SEAT MODULE	
• Ignition OFF. • Disconnect: Left Rear Heated Seat Module C3162. • Measure the resistance between left rear heated seat module C3162-8, circuit 8-HC21 (WH/GN), harness side and ground and between C3162-11, circuit 10-HC21 (GY/OG), harness side and ground while pressing the heated seat switch.	**Yes** GO to J3 . **No** GO to J2 .

 A0049205 • **Are the resistances less than 50 ohms when the heated seat switch is pressed and greater than 10,000 ohms when the heated seat switch is not pressed?**	
J2 CHECK HEATED SEAT SWITCH GROUND CIRCUIT 31-HC15 (BK/YE)	
• Disconnect: Left Rear Heated Seat Switch C722. • Measure the resistance between left rear heated seat switch C722-1, circuit 31-HC15 (BK/YE), harness side and ground.  A0061877 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new heated seat switch. TEST the system for normal operation. **No** REPAIR circuit 31-HC15 (BK/YE). TEST the system for normal operation.
J3 CHECK CIRCUIT 30-HC21 (RD/GN) FOR VOLTAGE TO THE HEATED SEAT MODULE	
• Measure the voltage between left rear heated seat module C3162-12, circuit 30-HC21 (RD/GN), harness side and ground.  A0042223 • **Is the voltage greater than 10 volts?**	**Yes** GO to J4 . **No** VERIFY battery junction box (BJB) fuse 11 (20A) is OK. If OK, REPAIR circuit 30-HC21 (RD/GN). TEST the system for normal operation.
J4 CHECK CIRCUIT 20-HC21D (PK/BK) FOR VOLTAGE TO THE HEATED SEAT MODULE	
• Ignition ON. • Measure the voltage between left rear heated seat module C3162-5, circuit 20-HC21D (PK/BK), harness side and ground.	**Yes** GO to J5 . **No** VERIFY central junction box (CJB) fuse 16 (5A) is OK. If OK, REPAIR circuit 20-HC21D (PK/BK). TEST the system for normal operation.

 A0042224 • **Is the voltage greater than 10 volts?**	
J5 CHECK HEATED SEAT MODULE GROUND CIRCUIT 31-HC15 (BK/YE)	
• Ignition OFF. • Measure the resistance between left rear heated seat module C3162-1, circuit 31-HC15 (BK/YE), harness side and ground.  A0042225 • **Is the resistance less than 5 ohms?**	**Yes** GO to J6 . **No** REPAIR circuit 31-HC15 (BK/YE). TEST the system for normal operation.
J6 CHECK THE SEAT CUSHION HEATER AND THE SEAT BACK HEATER CIRCUITS	
• Measure the resistance between left rear heated seat module C3162-6, circuit 20-HC17 (PK), harness side and C3162-7, circuit 31S-HC16 (BK/BU), harness side; and between left rear heated seat module C3162-6, circuit 20-HC17 (PK), harness side and ground.  A0050062 • **Is the resistance greater than 1.6 ohms and less than 10 ohms between C3162-6 and C3162-7 and greater than 10,000 ohms between C3162-6 and ground?**	**Yes** GO to J7 . **No** GO to J12 .
J7 CHECK THE SEAT CUSHION HEATER AND THE SEAT BACK HEATER CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between left rear heated seat module C3162-6, circuit 20-HC17 (PK), harness side and ground and between C3162-7, circuit 31S-HC16 (BK/BU), harness side and ground.	**Yes** REPAIR the circuit 20-HC17 (PK), 31S-HC16 (BK/BU) or 20S-HC16 (PK/BU). TEST the system for normal operation. **No** GO to J8 .

 A0050063 • **Is voltage present on either circuit?**	
J8 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR A SHORT TO VOLTAGE	
• Measure the voltage between left rear heated seat module C3162-3, circuit 9-HC23 (BN/YE), harness side and ground and between C3162-4, circuit 8-HC23 (WH/BK), harness side and ground.  A0050064 • **Is voltage present on either circuit?**	**Yes** REPAIR the affected circuit. TEST the system for normal operation. **No** GO to J9 .
J9 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS	
• Ignition OFF. • Measure the resistance between left rear heated seat module C3162-3, circuit 9-HC23 (BN/YE), harness side and C3162-4, circuit 8-HC23 (WH/BK), harness side; and between left rear heated seat module C3162-3, circuit 9-HC23 (BN/YE), harness side and ground.  A0050065 • **Is the resistance less than 300,000 ohms and greater than 50 ohms between C3162-3 and C3162-4 and greater than 10,000 ohms between C3162-3 and ground?**	**Yes** INSTALL a new left rear heated seat module. TEST the system for normal operation. **No** GO to J10 .
J10 CHECK CIRCUIT 9-HC23 (BN/YE) FOR AN OPEN OR SHORT TO GROUND	
• Disconnect: Left Rear Seat Cushion Heater C3167. • Measure the resistance between left rear heated seat module C3162-3, circuit 9-HC23 (BN/YE), harness side and left rear seat cushion heater C3167-3, circuit 9-HC23 (BN/YE), harness side; and between left rear heated seat module C3162-3, circuit 9-HC23 (BN/YE), harness side and ground.	**Yes** GO to J11 . **No** REPAIR circuit 9-HC23 (BN/YE). TEST the system for normal operation.

 A0042234 • **Is the resistance less than 5 ohms between the heated seat module and the seat cushion heater and greater than 10,000 ohms between the heated seat module and ground?**	
J11 CHECK CIRCUIT 8-HC23 (WH/BK) FOR AN OPEN OR SHORT TO GROUND	
• Measure the resistance between left rear heated seat module C3162-4, circuit 8-HC23 (WH/BK), harness side and left rear seat cushion heater C3167-2, circuit 8-HC23 (WH/BK), harness side; and between left rear heated seat module C3162-4, circuit 8-HC23 (WH/BK), harness side and ground.  A0042233 • **Is the resistance less than 5 ohms between the heated seat module and the seat cushion heater and greater than 10,000 ohms between the heated seat module and ground?**	**Yes** INSTALL a new left rear seat cushion heater. TEST the system for normal operation. **No** REPAIR circuit 8-HC23 (WH/BK). TEST the system for normal operation.
J12 CHECK CIRCUIT 32-HC17 (WH/BU) FOR OPEN OR SHORT TO GROUND	
• Disconnect: Left Rear Seat Cushion Heater C3167. • Measure the resistance between left rear heated seat module C3162-6, circuit 20S-HC17 (PK), harness side and left rear seat cushion heater C3167-1, circuit 20S-HC17 (PK), harness side; and between left rear heated seat module C3162-6, circuit 20S-HC17 (PK), harness side and ground.  A0042230 • **Is the resistance less than 1 ohm between the heated seat module and the seat cushion heater, and greater than 10,000 ohms between the heated seat module and ground?**	**Yes** GO to J13 . **No** REPAIR circuit 20S-HC17 (PK). TEST the system for normal operation.
J13 CHECK CIRCUIT 31S-HC16 (BK/BU) FOR AN OPEN OR A SHORT TO GROUND	

• Disconnect: Left Rear Seat Back Heater C3168. • Measure the resistance between left rear heated seat module C3162-7, circuit 31S-HC16 (BK/BU), harness side and left rear seat back heater C3168-2, circuit 31S-HC16 (BK/BU), harness side; and between left rear heated seat module C3162-7, circuit 31S-HC16 (BK/BU), harness side and ground.  A0048794 • **Is the resistance less than 5 ohms between the heated seat module and the seat back heater, and greater than 10,000 ohms between the heated seat module and ground?**	**Yes** GO to J14 . **No** REPAIR circuit 31S-HC16 (BK/BU). TEST the system for normal operation.
J14 CHECK CIRCUIT 20S-HC16 (PK/BU) FOR AN OPEN OR A SHORT TO GROUND	
• Measure the resistance between left rear seat cushion heater C3167-4, circuit 20S-HC16 (PK/BU), harness side and left rear seat back heater C3168-1, circuit 20S-HC16 (PK/BU), harness side; and between left rear seat cushion heater C3167-4, circuit 20S-HC16 (PK/BU), harness side and ground.  A0048795 • **Is the resistance less than 5 ohms between the seat cushion heater and the seat back heater, and greater than 10,000 ohms between the seat cushion heater and ground?**	**Yes** GO to J15 . **No** REPAIR circuit 20S-HC16 (PK/BU). TEST the system for normal operation.
J15 CHECK THE SEAT BACK HEATER	
• Disconnect: Left Rear Seat Back Heater Connector. • Measure the resistance between left rear seat back heater pin 1 and pin 2, seat back heater component side.  A0048777 • **Is the resistance between 0.6 and 0.9 ohm?**	**Yes** INSTALL a new left rear seat cushion heater. TEST the system for normal operation. **No** INSTALL a new left rear seat back heater. TEST the system for normal operation.

Pinpoint Test K: The Right Rear Heated Seat Is Inoperative

Normal Operation

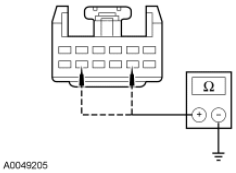
The right rear heated seat module is powered by battery voltage on circuit 30-HC21 (RD/GN) and by ignition voltage circuit 20-HC21D (PK/YE), and is supplied ground on circuit 31-HC21 (BK/GN). The heated seat switch has a high and low setting depending on selection. The heated seat switch uses the ground on circuit 31-HC18 (BK/GN) to provide a ground input to the heated seat module on circuit 8-HC21A (WH/GN) (high setting) or 10-HC21A (GY/OG) (low setting). The heated seat module supplies voltage to the heated seat elements in the seat cushion and the seat back.

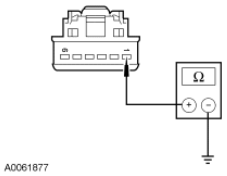
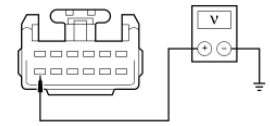
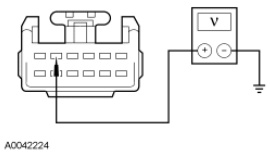
Possible Causes

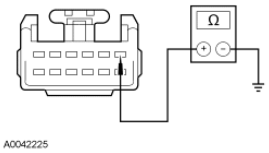
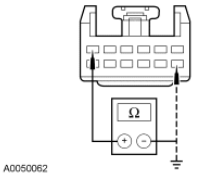
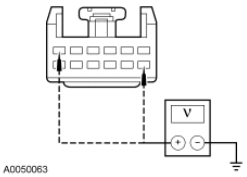
An inoperative heated seat can be caused by:

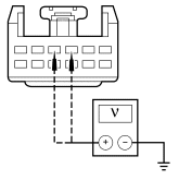
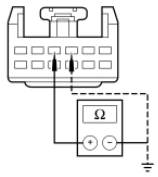
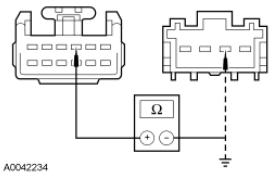
- fuse(s).
- wiring, terminals or connectors.
- a faulty heated seat switch.
- a faulty heated seat module.
- a faulty heated seat element.
- a faulty heated seat temperature sensor.

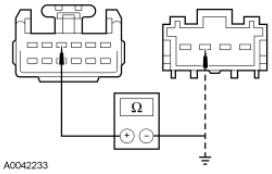
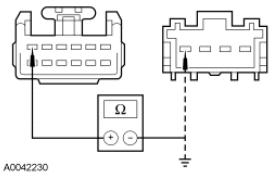
PINPOINT TEST K: THE RIGHT REAR HEATED SEAT IS INOPERATIVE

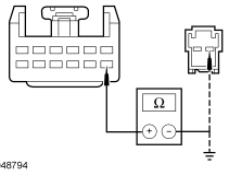
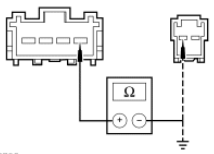
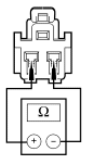
Test Step	Result / Action to Take
K1 CHECK THE HEATED SEAT SWITCH INPUT TO THE HEATED SEAT MODULE	
• Ignition OFF. • Disconnect: Right Rear Heated Seat Module C3163. • Measure the resistance between right rear heated seat module C3163-8, circuit 8-HC21 (WH/GN), harness side and ground and between C3163-11, circuit 10-HC21A (GY/OG), harness side and ground while pressing the heated seat switch.  A0049205 • **Are the resistances less than 5 ohms when the heated seat switch is pressed?**	**Yes** GO to K3 . **No** GO to K2 .
K2 CHECK HEATED SEAT SWITCH GROUND CIRCUIT 31-HC21 (BK/GN)	

• Disconnect: Right Rear Heated Seat Switch C822. • Measure the resistance between right rear heated seat switch C822-1, circuit 31-HC21 (BK/GN), harness side and ground.  A0061877 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new heated seat switch. TEST the system for normal operation. **No** REPAIR circuit 31-HC21 (BK/GN). TEST the system for normal operation.
K3 CHECK CIRCUIT 30-HC21 (RD/GN) FOR VOLTAGE TO THE HEATED SEAT MODULE	
• Measure the voltage between right rear heated seat module C3163-12, circuit 30-HC21 (RD/GN), harness side and ground.  A0042223 • **Is the voltage greater than 10 volts?**	**Yes** GO to K4 . **No** VERIFY battery junction box (BJB) fuse 11 (20A) is OK. If OK, REPAIR circuit 30-HC21 (RD/GN). TEST the system for normal operation.
K4 CHECK CIRCUIT 20-HC21D (PK/BK) FOR VOLTAGE TO THE HEATED SEAT MODULE	
• Ignition ON. • Measure the voltage between right rear heated seat module C3163-5, circuit 20-HC21D (PK/BK), harness side and ground.  A0042224 • **Is the voltage greater than 10 volts?**	**Yes** GO to K5 . **No** VERIFY central junction box (CJB) fuse 16 (5A) is OK. If OK, REPAIR circuit 20-HC21D (PK/BK). TEST the system for normal operation.
K5 CHECK HEATED SEAT MODULE GROUND CIRCUIT 31-HC21 (BK/GN)	
• Ignition OFF. • Measure the resistance between right rear heated seat module C3163-1, circuit 31-HC21 (BK/GN), harness side and ground.	**Yes** GO to K6 . **No** REPAIR circuit 31-HC21 (BK/GN). TEST the system for normal operation.

 A0042225 • **Is the resistance less than 5 ohms?**	
K6 CHECK THE SEAT CUSHION HEATER AND THE SEAT BACK HEATER CIRCUITS	
• Measure the resistance between right rear heated seat module C3163-6, circuit 20-HC17 (PK), harness side and C3163-7, circuit 31S-HC16 (BK/BU), harness side; and between right rear heated seat module C3163-6, circuit 20-HC17 (PK), harness side and ground.  A0050062 • **Is the resistance greater than 1.6 ohms and less than 10 ohms between C3163-6 and C3163-7 and greater than 10,000 ohms between C3163-6 and ground?**	**Yes** GO to K7 . **No** GO to K12 .
K7 CHECK THE SEAT CUSHION HEATER AND THE SEAT BACK HEATER CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between right rear heated seat module C3163-6, circuit 20-HC17 (PK), harness side and ground and between C3163-7, circuit 31S-HC16 (BK/BU), harness side and ground.  A0050063 • **Is voltage present on either circuit?**	**Yes** REPAIR the circuit 20-HC17 (PK), 31S-HC16 (BK/BU) or 20S-HC16 (PK/BU). TEST the system for normal operation. **No** GO to K8 .
K8 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR A SHORT TO VOLTAGE	
• Measure the voltage between right rear heated seat module C3163-3, circuit 9-HC23 (BN/YE), harness side and ground and between C3163-4, circuit 8-HC23 (WH/BK), harness side and ground.	**Yes** REPAIR the affected circuit. TEST the system for normal operation. **No** GO to K9 .

 • **Is voltage present on either circuit?**	
K9 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS	
• Ignition OFF. • Measure the resistance between right rear heated seat module C3163-3, circuit 9-HC23 (BN/YE), harness side and C3163-4, circuit 8-HC23 (WH/BK), harness side; and between right rear heated seat module C3163-3, circuit 9-HC23 (BN/YE), harness side and ground.  • **Is the resistance less than 300,000 ohms and greater than 50 ohms between C3163-3 and C3163-4 and greater than 10,000 ohms between C3163-3 and ground?**	**Yes** INSTALL a new right rear heated seat module. TEST the system for normal operation. **No** GO to K10 .
K10 CHECK CIRCUIT 9-HC23 (BN/YE) FOR AN OPEN OR SHORT TO GROUND	
• Disconnect: Right Rear Seat Cushion Heater C3169. • Measure the resistance between right rear heated seat module C3163-3, circuit 9-HC23 (BN/YE), harness side and right rear seat cushion heater C3169-3, circuit 9-HC23 (BN/YE), harness side; and between right rear heated seat module C3163-3, circuit 9-HC23 (BN/YE), harness side and ground.  • **Is the resistance less than 5 ohms between the heated seat module and the seat cushion heater and greater than 10,000 ohms between the heated seat module and ground?**	**Yes** GO to K11 . **No** REPAIR circuit 9-HC23 (BN/YE). TEST the system for normal operation.
K11 CHECK CIRCUIT 8-HC23 (WH/BK) FOR AN OPEN OR SHORT TO GROUND	

• Measure the resistance between right rear heated seat module C3163-4, circuit 8-HC23 (WH/BK), harness side and right rear seat cushion heater C3169-2, circuit 8-HC23 (WH/BK), harness side; and between right rear heated seat module C3163-4, circuit 8-HC23 (WH/BK), harness side and ground.  • **Is the resistance less than 5 ohms between the heated seat module and the seat cushion heater and greater than 10,000 ohms between the heated seat module and ground?**	**Yes** INSTALL a new right rear seat cushion heater. TEST the system for normal operation. **No** REPAIR circuit 8-HC23 (WH/BK). TEST the system for normal operation.
K12 CHECK CIRCUIT 20-HC17 (PK) FOR OPEN OR SHORT TO GROUND	
• Disconnect: Right Rear Seat Cushion Heater C3169. • Measure the resistance between right rear heated seat module C3163-6, circuit 20-HC17 (PK), harness side and right rear seat cushion heater C3169-1, circuit 20-HC17 (PK), harness side; and between right rear heated seat module C3163-6, circuit 20-HC17 (PK), harness side and ground.  • **Is the resistance less than 1 ohm between the heated seat module and the seat cushion heater, and greater than 10,000 ohms between the heated seat module and ground?**	**Yes** GO to K13 . **No** REPAIR circuit 20-HC17 (PK). TEST the system for normal operation.
K13 CHECK CIRCUIT 31S-HC16 (BK/BU) FOR AN OPEN OR A SHORT TO GROUND	
• Disconnect: Right Rear Seat Back Heater C3170. • Measure the resistance between right rear heated seat module C3163-7, circuit 31S-HC16 (BK/BU), harness side and right rear seat back heater C3170-2, circuit 31S-HC16 (BK/BU), harness side; and between right rear heated seat module C3163-7, circuit 31S-HC16 (BK/BU), harness side and ground.	**Yes** GO to K14 . **No** REPAIR circuit 31S-HC16 (BK/BU). TEST the system for normal operation.

 A0048794 • **Is the resistance less than 5 ohms between the heated seat module and the seat back heater, and greater than 10,000 ohms between the heated seat module and ground?**	
K14 CHECK CIRCUIT 20S-HC16 (PK/BU) FOR AN OPEN OR A SHORT TO GROUND	
• Measure the resistance between right rear seat cushion heater C3169-4, circuit 20S-HC16 (PK/BU), harness side and right rear seat back heater C3170-1, circuit 20S-HC16 (PK/BU), harness side; and between right rear seat cushion heater C3169-4, circuit 20S-HC16 (PK/BU), harness side and ground.  A0048795 • **Is the resistance less than 5 ohms between the seat cushion heater and the seat back heater, and greater than 10,000 ohms between the seat cushion heater and ground?**	**Yes** GO to K15 . **No** REPAIR circuit 20S-HC16 (PK/BU). TEST the system for normal operation.
K15 CHECK THE SEAT BACK HEATER	
• Disconnect: Right Seat Back Heater Connector. • Measure the resistance between right rear seat back heater pin 1 and pin 2, seat back heater component side.  A0048777 • **Is the resistance between 0.6 and 0.9 ohm?**	**Yes** INSTALL a new right rear seat cushion heater. TEST the system for normal operation. **No** INSTALL a new right rear seat back heater. TEST the system for normal operation.

Pinpoint Test L: The Left Rear Heated Seat Is Inoperative — Does Not Operate In High

Normal Operation

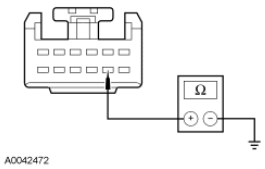
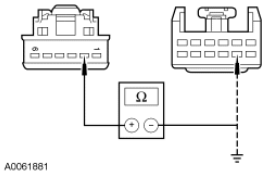
The heated seat switch uses circuit 8-HC21A (WH/GN) for the high setting input to the heated seat module.

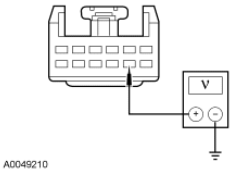
Possible Causes

A left rear heated seat that does not operate in high can be caused by:

- wiring, terminals or connectors.
- a faulty heated seat switch.
- a faulty heated seat module.

PINPOINT TEST L: THE LEFT REAR HEATED SEAT IS INOPERATIVE — DOES NOT OPERATE IN HIGH

Test Step	Result / Action to Take
L1 CHECK THE HEATED SEAT SWITCH INPUT TO THE HEATED SEAT MODULE	
• Ignition OFF. • Disconnect: Left Rear Heated Seat Module C3162. • Measure the resistance between left rear heated seat module C3162-8, circuit 8-HC21 (WH/GN), harness side and ground while pressing the heated seat switch.  A0042472 • **Is the resistance less than 50 ohms when the heated seat switch is pressed and greater than 10,000 ohms when the heated seat switch is not pressed?**	**Yes** INSTALL a new heated seat module. TEST the system for normal operation. **No** GO to L2 .
L2 CHECK CIRCUIT 8-HC21 (WH/GN) FOR OPEN OR SHORT TO GROUND	
• Disconnect: Left Rear Heated Seat Switch C722. • Measure the resistance between left rear heated seat switch C722-2, circuit 8-HC21 (WH/GN), harness side and left rear heated seat module C3162-8, circuit 8-HC21 (WH/GN), harness side; and between left rear heated seat switch C722-2, circuit 8-HC21 (WH/GN), harness side and ground.  A0061881 • **Is the resistance less than 1 ohm between the heated seat switch and the heated seat module and greater than 10,000 ohms between the heated seat switch and ground?**	**Yes** GO to L3 . **No** REPAIR circuit 8-HC21 (WH/GN). TEST the system for normal operation.
L3 CHECK CIRCUIT 8-HC21 (WH/GN) FOR SHORT TO VOLTAGE	

• Ignition ON. • Measure the voltage between left rear heated seat module C3162-8, circuit 8-HC21 (WH/GN), harness side and ground.  A0049210 • **Is voltage present?**	**Yes** REPAIR circuit 8-HC21 (WH/GN). TEST the system for normal operation. **No** INSTALL a new heated seat switch. TEST the system for normal operation.

Pinpoint Test M: The Left Rear Heated Seat Is Inoperative — Does Not Operate In Low

Normal Operation

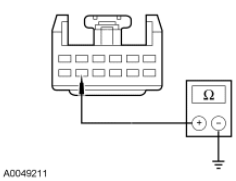
The heated seat switch uses circuit 10-HC21 (GY/OG) for the low setting input to the heated seat module.

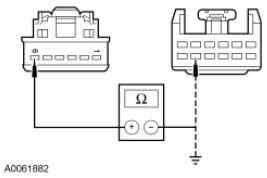
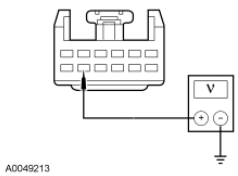
Possible Causes

A left rear heated seat that does not operate in low can be caused by:

- wiring, terminals or connectors.
- a faulty heated seat switch.
- a faulty heated seat module.

PINPOINT TEST M: THE LEFT REAR HEATED SEAT IS INOPERATIVE — DOES NOT OPERATE IN LOW

Test Step	Result / Action to Take
M1 CHECK THE HEATED SEAT SWITCH INPUT TO THE HEATED SEAT MODULE	
• Ignition OFF. • Disconnect: Left Rear Heated Seat Module C3162. • Measure the resistance between left rear heated seat module C3162-11, circuit 10-HC21 (GY/OG), harness side and ground while pressing the heated seat switch.  A0049211 • **Is the resistance less than 50 ohms when the heated seat switch is pressed and greater than 10,000 ohms when the heated seat switch is not pressed?**	**Yes** INSTALL a new heated seat module. TEST the system for normal operation. **No** GO to M2 .

M2 CHECK CIRCUIT 10-HC21 (GY/OG) FOR OPEN OR SHORT TO GROUND	
• Disconnect: Left Rear Heated Seat Switch C722. • Measure the resistance between left rear heated seat switch C722-6, circuit 10-HC21 (GY/OG), harness side and left rear heated seat module C3162-11, circuit 10-HC21 (GY/OG), harness side; and between left rear heated seat switch C722-6, circuit 10-HC21 (GY/OG), harness side and ground.  A0061882 • **Is the resistance less than 1 ohm between the heated seat switch and the heated seat module and greater than 10,000 ohms between the heated seat switch and ground?**	**Yes** GO to M3 . **No** REPAIR circuit 10-HC21 (GY/OG). TEST the system for normal operation.
M3 CHECK CIRCUIT 10-HC21 (GY/OG) FOR SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between left rear heated seat module C3162-11, circuit 10-HC21 (GY/OG), harness side and ground.  A0049213 • **Is voltage present?**	**Yes** REPAIR circuit 10-HC21 (GY/OG). TEST the system for normal operation. **No** INSTALL a new heated seat switch. TEST the system for normal operation.

Pinpoint Test N: The Right Rear Heated Seat Is Inoperative — Does Not Operate In High

Normal Operation

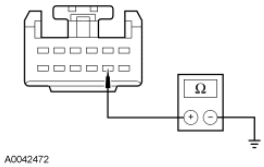
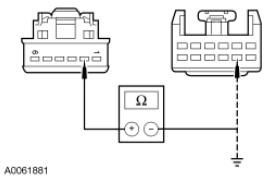
The heated seat switch uses circuit 8-HC18 (WH/GN) for the high setting input to the heated seat module.

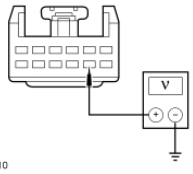
Possible Causes

A right rear heated seat that does not operate in high can be caused by:

- wiring, terminals or connectors.
- a faulty heated seat switch.
- a faulty heated seat module.

PINPOINT TEST N: THE RIGHT REAR HEATED SEAT IS INOPERATIVE — DOES NOT OPERATE IN HIGH

Test Step	Result / Action to Take
N1 CHECK THE HEATED SEAT SWITCH INPUT TO THE HEATED SEAT MODULE	
• Ignition OFF. • Disconnect: Right Rear Heated Seat Module C3163. • Measure the resistance between right rear heated seat module C3163-8, circuit 8-HC21 (WH/GN), harness side and ground while pressing the heated seat switch.  A0042472 • **Is the resistance less than 50 ohms when the heated seat switch is pressed and greater than 10,000 ohms when the heated seat switch is not pressed?**	**Yes** INSTALL a new heated seat module. TEST the system for normal operation. **No** GO to N2 .
N2 CHECK CIRCUIT 8-HC21 (WH/GN) FOR OPEN OR SHORT TO GROUND	
• Disconnect: Right Rear Heated Seat Switch C822. • Measure the resistance between right rear heated seat switch C822-2, circuit 8-HC21 (WH/GN), harness side and right rear heated seat module C3163-8, circuit 8-HC21 (WH/GN), harness side; and between right rear heated seat switch C822-2, circuit 8-HC21 (WH/GN), harness side and ground.  A0061881 • **Is the resistance less than 1 ohm between the heated seat switch and the heated seat module and greater than 10,000 ohms between the heated seat switch and ground?**	**Yes** GO to N3 . **No** REPAIR circuit 8-HC21 (WH/GN). TEST the system for normal operation.
N3 CHECK CIRCUIT 8-HC21 (WH/GN) FOR SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between right rear heated seat module C3163-8, circuit 8-HC21 (WH/GN), harness side and ground.	**Yes** REPAIR circuit 8-HC21 (WH/GN). TEST the system for normal operation. **No** INSTALL a new heated seat switch. TEST the

 A0049210 • **Is voltage present?**	system for normal operation.

Pinpoint Test O: The Right Rear Heated Seat Is Inoperative — Does Not Operate In Low

Normal Operation

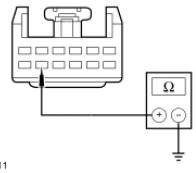
The heated seat switch uses circuit 10-HC18 (GY/OG) for the low setting input to the heated seat module.

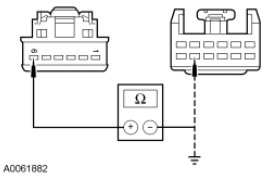
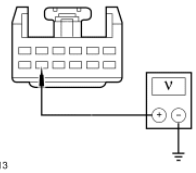
Possible Causes

A right rear heated seat that does not operate in low can be caused by:

- wiring, terminals or connectors.
- a faulty heated seat switch.
- a faulty heated seat module.

PINPOINT TEST O: THE RIGHT REAR HEATED SEAT IS INOPERATIVE — DOES NOT OPERATE IN LOW

Test Step	Result / Action to Take
O1 CHECK THE HEATED SEAT SWITCH INPUT TO THE HEATED SEAT MODULE	
• Ignition OFF. • Disconnect: Right Rear Heated Seat Module C3163. • Measure the resistance between right rear heated seat module C3163-11, circuit 10-HC21 (GY/OG), harness side and ground while pressing the heated seat switch.  A0049211 • **Is the resistance less than 50 ohms when the heated seat switch is pressed and greater than 10,000 ohms when the heated seat switch is not pressed?**	**Yes** INSTALL a new heated seat module. TEST the system for normal operation. **No** GO to O2 .
O2 CHECK CIRCUIT 10-HC21 (GY/OG) FOR OPEN OR SHORT TO GROUND	
• Disconnect: Right Rear Heated Seat Switch C822. • Measure the resistance between right rear heated seat switch C822-6, circuit 10-HC21 (GY/OG), harness side and right rear heated seat module C3163-11, circuit 10-HC21 (GY/OG), harness side; and	**Yes** GO to O3 . **No** REPAIR circuit

between right rear heated seat switch C822-6, circuit 10-HC21 (GY/OG), harness side and ground.  A0061882 • **Is the resistance less than 1 ohm between the heated seat switch and the heated seat module and greater than 10,000 ohms between the heated seat switch and ground?**	10-HC21 (GY/OG). TEST the system for normal operation.
O3 CHECK CIRCUIT 10-HC21 (GY/OG) FOR SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between right rear heated seat module C3163-11, circuit 10-HC21 (GY/OG), harness side and ground.  A0049213 • **Is voltage present?**	**Yes** REPAIR circuit 10-HC21 (GY/OG). TEST the system for normal operation. **No** INSTALL a new heated seat switch. TEST the system for normal operation.

Pinpoint Test P: The Power Lumbar Is Inoperative — Driver

Normal Operation

The power lumbar operation is incorporated into the power seat switch. The driver power seat switch is powered by battery voltage on circuit 30-AH40 (RD/GN) and is supplied ground on circuit 31-AH40 (BK/GN). When the lumbar knob of the power seat switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the lumbar knob in the opposite direction, the power seat switch reverses the polarity to the power lumbar motor, which moves the lumbar mechanism in the opposite direction.

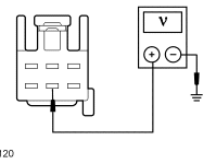
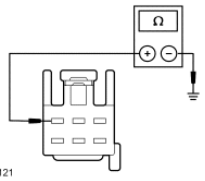
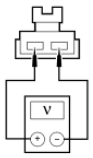
Possible Causes

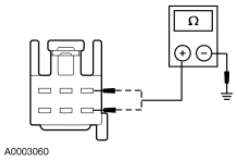
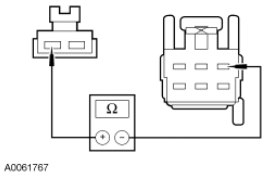
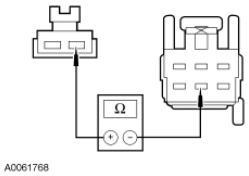
An inoperative driver power lumbar can be caused by:

- a fuse.
- wiring, terminals or connectors.
- a faulty seat control switch.
- a faulty power lumbar motor assembly.

PINPOINT TEST P: THE POWER LUMBAR IS INOPERATIVE — DRIVER

Test Step	Result / Action to Take
P1 CHECK CIRCUIT 30-AH40 (RD/GN) FOR AN OPEN	
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards. **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316. • Connect: Battery Ground Cable. • **⚠ WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Disconnect: Driver Seat Lumbar Control Switch C361. • Measure the voltage between driver seat lumbar control switch C361-5, circuit 30-AH40 (RD/GN), harness side and ground.	**Yes** GO to P2 . **No** VERIFY battery junction box (BJB) fuse 21 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

 A0003120 • **Is the voltage greater than 10 volts?**	
P2 CHECK CIRCUIT 31-AH40 (BK/GN) FOR AN OPEN	
• Measure the resistance between driver seat lumbar control switch C361-3, circuit 31-AH40 (BK/GN), harness side and ground.  A0003121 • **Is the resistance less than 5 ohms?**	**Yes** GO to P3 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
P3 CHECK THE DRIVER SEAT LUMBAR MOTOR	
• Connect: Driver Seat Lumbar Control Switch C361. • Disconnect: Driver Seat Lumbar Motor C366. • Measure the voltage between driver seat lumbar motor C366-2, circuit 32-AH39 (WH/BU), harness side and driver seat lumbar motor C366-1, circuit 33-AH39 (YE/BU), harness side.  A0061766 • Operate the driver seat lumbar control switch in both directions. • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new driver seat lumbar motor. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to P4 .
P4 CHECK CIRCUIT 32-AH39 (WH/BU) AND 33-AH39 (YE/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Driver Seat Lumbar Control Switch C361. • Measure the resistance between driver seat lumbar control switch C361-1, circuit 32-AH39 (WH/BU), harness side and ground;	**Yes** GO to P5 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint

and between driver seat lumbar control switch C361-4, circuit 33-AH39 (YE/BU), harness side and ground.  A0003060 • **Are the resistances greater than 10,000 ohms?**	system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
P5 CHECK CIRCUIT 32-AH39 (WH/BU) FOR AN OPEN	
• Measure the resistance between driver seat lumbar control switch C361-1, circuit 32-AH39 (WH/BU), harness side and driver seat lumbar motor C366-2, circuit 32-AH39 (WH/BU), harness side.  A0061767 • **Is the resistance less than 5 ohms?**	**Yes** GO to P6 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
P6 CHECK CIRCUIT 33-AH39 (YE/BU) FOR AN OPEN	
• Measure the resistance between driver seat lumbar control switch C361-4, circuit 33-AH39 (YE/BU), harness side and driver seat lumbar motor C366-1, circuit 33-AH39 (YE/BU), harness side.  A0061768 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver seat lumbar control switch. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test Q: The Power Lumbar Is Inoperative — Passenger

Normal Operation

The power lumbar operation is incorporated into the power seat switch. The passenger power seat switch is powered by battery voltage on circuit 30-AH46 (RD) and is supplied ground on circuit 31-AH46 (BK). When the lumbar knob of the power seat switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the lumbar knob in the opposite direction, the power seat switch reverses the polarity to the power lumbar motor, which moves the lumbar mechanism in the opposite direction.

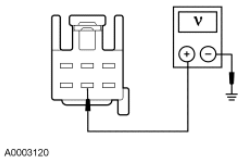
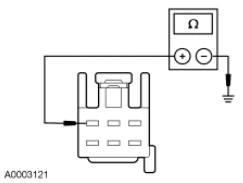
Possible Causes

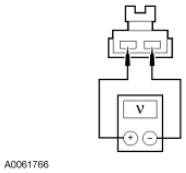
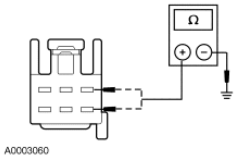
An inoperative passenger power lumbar can be caused by:

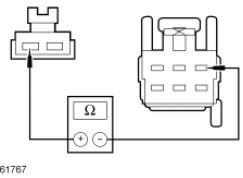
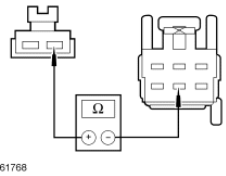
- a fuse.
- wiring, terminals or connectors.
- a faulty seat control switch.
- a faulty power lumbar motor assembly.

PINPOINT TEST Q: THE POWER LUMBAR IS INOPERATIVE — PASSENGER

Test Step	Result / Action to Take
Q1 CHECK CIRCUIT 30-AH46 (RD) FOR AN OPEN	
⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF.	**Yes** GO to Q2 . **No** VERIFY battery junction box (BJB) fuse 28 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

• Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Passenger Seat Side Air Bag Module C314. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Passenger Seat Side Air Bag Module C314. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Disconnect: Passenger Seat Lumbar Control Switch C331. • Ignition ON. • Measure the voltage between passenger seat lumbar control switch C331-5, circuit 30-AH46 (RD), harness side and ground.  A0003120 • **Is the voltage greater than 10 volts?**	
Q2 CHECK CIRCUIT 31-AH46 (BK) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between passenger seat lumbar control switch C331-3, circuit 31-AH46 (BK), harness side and ground.  A0003121 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q3 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
Q3 CHECK THE PASSENGER SEAT LUMBAR MOTOR	

• Connect: Passenger Seat Lumbar Control Switch C331. • Disconnect: Passenger Seat Lumbar Motor C336. • Measure the voltage between passenger seat lumbar motor C336-2, circuit 32-AH23 (WH/BU), harness side and passenger seat lumbar motor C336-1, circuit 33-AH23 (YE/BU), harness side.  A0061766 • Operate the passenger seat lumbar control switch in both directions. • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new driver seat lumbar motor. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to Q4 .
Q4 CHECK CIRCUIT 32-AH45 (WH/BU) AND 33-AH45 (YE/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Passenger Seat Lumbar Control Switch C331. • Measure the resistance between passenger seat lumbar control switch C331-1, circuit 32-AH45 (WH/BU), harness side and ground; and between passenger seat lumbar control switch C331-4, circuit 33-AH45 (YE/BU), harness side and ground.  A0003060 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to Q5 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
Q5 CHECK CIRCUIT 32-AH45 (WH/BU) FOR AN OPEN	
• Measure the resistance between passenger seat lumbar control switch C331-1, circuit 32-AH45 (WH/BU), harness side and passenger seat lumbar motor C336-2, circuit 32-AH45	**Yes** GO to Q6 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable.

(WH/BU), harness side.  • **Is the resistance less than 5 ohms?**	DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
Q6 CHECK CIRCUIT 33-AH45 (YE/BU) FOR AN OPEN	
• Measure the resistance between passenger seat lumbar control switch C331-4, circuit 33-AH45 (YE/BU), harness side and passenger seat lumbar motor C336-1, circuit 33-AH45 (YE/BU), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new passenger seat lumbar control switch. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test R: DTC B1676 Battery Pack Voltage Out Of Range

Normal Operation

The DSM is powered by battery voltage from circuit 29-AH35 (OG/YE) and 30-AH80 (RD) and is supplied ground on circuit 31-AH80 (BK).

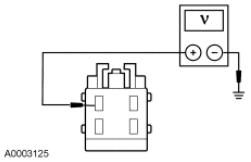
Possible Causes

DTC B1676 battery pack voltage out of range can be caused by:

- a faulty DSM.

PINPOINT TEST R: DTC B1676 BATTERY PACK VOLTAGE OUT OF RANGE

Test Step	Result / Action to Take
R1 CHECK FOR VOLTAGE AT THE DSM	

⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards. **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316. • Connect: Battery Ground Cable. • **⚠ WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Disconnect: DSM C341b. • Ignition ON. • Measure the voltage between DSM C341b-4, circuit 30-AH80 (RD), harness side and ground.  • **Is the voltage between 11.5 and 16 volts?**	**Yes** CLEAR the DTC. REPEAT the DSM self-test. If DTC B1676 is retrieved, INSTALL a new DSM. REFER to Section 418-00 . TEST the system for normal operation. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** REFER to Section 414-00 for battery and charging system repair.

Pinpoint Test S: DTC B1358 — Ignition Switch Or Blower Electronics Circuit Short To Ground/DTC B2521 — Tach Circuit Failure

Normal Operation

The climate controlled seat module (CCSM) provides voltage on circuit 8-FA18 (WH/BK) and ground on circuit 31S-FA18 (BK/RD) to operate the climate controlled seat blower fan. The CCSM also supplies voltage on circuit 20S-FA18 (PK/OG) that is used by the climate controlled seat blower fan to provide a feedback voltage to the CCSM indicating climate controlled seat blower fan speed.

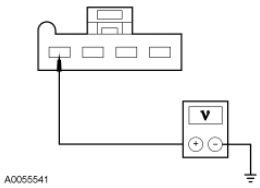
Possible Causes

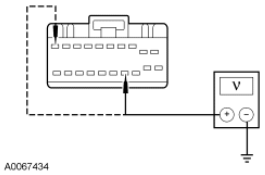
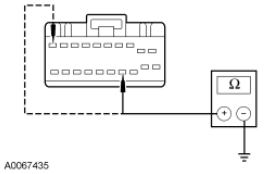
A blower electronics short to ground or tach circuit failure can be caused by:

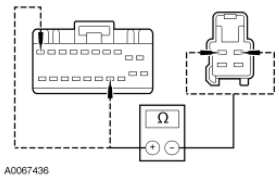
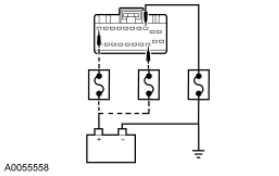
- a fuse.
- wiring, terminals or connectors.
- CCSM.
- climate controlled seat blower fan.

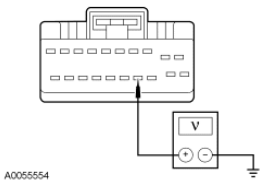
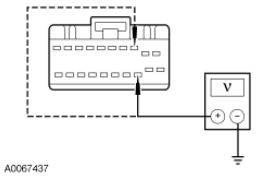
PINPOINT TEST S: DTC B1358 — IGNITION SWITCH OR BLOWER ELECTRONICS CIRCUIT SHORT TO GROUND/DTC B2521 — TACH CIRCUIT FAILURE

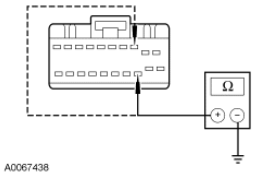
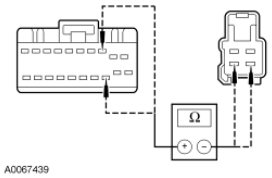
Test Step	Result / Action to Take
S1 CHECK CIRCUIT 30-HC21 (RD/GN) OR CIRCUIT 30-HC22 (RD/YE)	
⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314.	**Yes** GO to S2 . **No** VERIFY battery junction box (BJB) fuse 26 (30A) is OK. If OK, REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

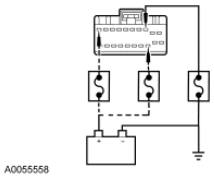
• Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Disconnect: Driver CCSM C3031a or Passenger CCSM C3036a. • Ignition ON. • Measure the voltage between driver CCSM C3031a-4, circuit 30-HC21 (RD/GN), harness side and ground or passenger CCSM C3036a-4, circuit 30-HC22 (RD/YE), harness side and ground.  • **Is the voltage greater than 10 volts?**	
S2 CHECK THE FAN MOTOR RPM INPUT	
• Ignition OFF. • Connect: Driver CCSM C3031a or Passenger CCSM C3036a. • Ignition ON. • Enter the following diagnostic mode on the scan tool: CCSM Active Command Menu TURN BLOWER FULL POWER. • **NOTE:** After the active command FULL BLOW is commanded to the ON state, the climate controlled seat blower fan will operate for 15 seconds then turn OFF. • **NOTE:** The CCSM is not the source of the fault if the active command mode is operational. • Monitor the CCSM PID CLIMATE CONTROLLED SEAT BLOWER RPM while commanding the FULL BLOW active command ON then OFF. • **Does the PID value change when the climate controlled seat blower fan was commanded ON and OFF?**	**Yes** CHECK for causes of the intermittent fault. INSPECT the connectors, terminals and wiring. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to S3 .
S3 VERIFY THE CLIMATE CONTROLLED SEAT BLOWER FAN OPERATION	
• **NOTE:** After the active command FULL BLOW is commanded to the ON state, the climate controlled seat blower fan will operate for 15 seconds then	**Yes** GO to S4 . **No**

turn OFF. • **NOTE:** The CCSM is not the source of the fault if the active command mode is operational. • Command the FULL BLOW active command ON then OFF and note the climate controlled seat blower fan operation. • **Does the climate controlled seat blower fan operate?**	GO to S8 .
S4 CHECK CIRCUIT 10-FA18 (GY/BK) AND CIRCUIT 20S-FA18 (PK/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Driver CCSM C3031b or Passenger CCSM C3036b. • Disconnect: Driver Climate Controlled Seat Blower Fan C3033 or Passenger Climate Controlled Seat Blower Fan C3038. • Ignition ON. • Measure the voltage between driver CCSM C3031b-10 (or passenger CCSM C3036b-10), circuit 20S-FA18 (PK/OG), harness side and ground; and between driver CCSM C3031b-14 (or passenger CCSM C3036b-14), circuit 10-FA18 (GY/BK), harness side and ground.  A0067434 • **Are the voltages less than 0.2 volt?**	**Yes** GO to S5 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
S5 CHECK CIRCUIT 10-FA18 (GY/BK) AND CIRCUIT 20S-FA18 (PK/OG) FOR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between driver CCSM C3031b-10 (or passenger CCSM C3036b-10), circuit 20S-FA18 (PK/OG), harness side and ground; and between driver CCSM C3031b-14 (or passenger CCSM C3036b-14), circuit 10-FA18 (GY/BK), harness side and ground.  A0067435	**Yes** GO to S6 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

• **Are the resistances greater than 10,000 ohms?**	
S6 CHECK CIRCUIT 10-FA18 (GY/BK) AND CIRCUIT 20S-FA18 (PK/OG) FOR AN OPEN	
• Measure the resistance between driver CCSM C3031b-10 (or passenger CCSM C3036b-10), circuit 20S-FA18 (PK/OG), harness side and driver climate controlled seat blower fan C3033-1 (or passenger climate controlled seat blower fan C3038-1), circuit 20S-FA18 (PK/OG), harness side; and between driver CCSM C3031b-14 (or passenger CCSM C3036b-14), circuit 10-FA18 (GY/BK), harness side and driver climate controlled seat blower fan C3033-2 (or passenger climate controlled seat blower fan C3038-2), circuit 10-FA18 (GY/BK), harness side.  A0067436 • **Are the resistances less than 5 ohms?**	**Yes** GO to S7 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
S7 CHECK THE CLIMATE CONTROLLED SEAT BLOWER FAN OUTPUT	
• Connect: Driver Climate Controlled Seat Blower Fan C3033 or Passenger Climate Controlled Seat Blower Fan C3038. • Connect fused (5A) jumper leads between driver CCSM C3031b (or passenger CCSM C3036b) as follows: ♦ Driver CCSM C3031b-10 (or passenger CCSM C3036b-10), circuit 20S-FA18 (PK/OG), harness side and battery positive. ♦ Driver CCSM C3031b-13 (or passenger CCSM C3036b-13), circuit 8-FA18 (WH/BK), harness side and battery positive. ♦ Driver CCSM C3031b-3 (or passenger CCSM C3036b-3), circuit 31S-FA18 (BK/RD), harness side and ground.  A0055558 • Measure the voltage between driver CCSM C3031b-14 (or passenger CCSM C3036b-14),	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new climate controlled seat blower fan. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag

circuit 10-FA18 (GY/BK), harness side and ground.  • **Is voltage present?**	module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
S8 CHECK CIRCUIT 31S-FA18 (BK/RD) AND CIRCUIT 8-FA18 (WH/BK) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Driver CCSM C3031b or Passenger CCSM C3036b. • Disconnect: Driver Climate Controlled Seat Blower Fan C3033 or Passenger Climate Controlled Seat Blower Fan C3038. • Ignition ON. • Measure the voltage between driver CCSM C3031b-3 (or passenger CCSM C3036b-3), circuit 31S-FA18 (BK/RD), harness side and ground; and between driver CCSM C3031b-13 (or passenger CCSM C3136b-13), circuit 8-FA18 (WH/BK), harness side and ground.  • **Are the voltages less than 0.2 volt?**	**Yes** GO to S9 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
S9 CHECK CIRCUIT 31S-FA18 (BK/RD) AND CIRCUIT 8-FA18 (WH/BK) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between driver CCSM C3031b-3 (or passenger CCSM C3036b-3), circuit 31S-FA18 (BK/RD), harness side and ground; and between driver CCSM C3031b-13 (or passenger CCSM C3136b-13), circuit 8-FA18 (WH/BK), harness side and ground.	**Yes** GO to S10 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER

 A0067438 • **Are the resistances greater than 10,000 ohms?**	the supplemental restraint system (SRS). REFER to Section 501-20B .
S10 CHECK CIRCUIT 31S-FA18 (BK/RD) AND CIRCUIT 8-FA18 (WH/BK) FOR AN OPEN	
• Measure the resistance between driver CCSM C3031b-3 (or passenger CCSM C3036b-3), circuit 31S-FA18 (BK/RD), harness side and driver climate controlled seat blower fan C3033-4 (or passenger climate controlled seat blower fan C3038-4), circuit 31S-FA18 (RD/BK), harness side; and between driver CCSM C3031b-13 (or passenger CCSM C3036b-13), circuit 8-FA18 (WH/BK), harness side and driver climate controlled seat blower fan C3033-3 (or passenger climate controlled seat blower fan C3038-3), circuit 8-FA18 (WH/BK), harness side.  A0067439 • **Are the resistances less than 5 ohms?**	**Yes** GO to S11 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
S11 CHECK THE CLIMATE CONTROLLED BLOWER FAN OPERATION	
• Connect: Driver Climate Controlled Seat Blower Fan C3033 or Passenger Climate Controlled Seat Blower Fan C3038. • Connect fused (5A) jumper leads between driver CCSM C3031b (or passenger CCSM C3036b) as follows: ♦ Driver CCSM C3031b-10 (or passenger CCSM C3036b-10), circuit 20S-FA18 (PK/OG), harness side and battery positive. ♦ Driver CCSM C3031b-13 (or passenger CCSM C3036b-13), circuit 8-FA18 (WH/BK), harness side and battery positive. ♦ Driver CCSM C3031b-3 (or passenger CCSM C3036b-3), circuit 31S-FA18 (BK/RD), harness side and ground.	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new climate controlled seat blower fan. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal

 A0055558 • **Does the climate controlled seat blower fan operate?**	operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test T: DTC B2729 — Cushion Over-Temp Detected/DTC B2730 — Back Over-Temp Detected/DTC B2731 — Differential Temperature Fault — Driver Seat

Normal Operation

Each thermo-electric device (TED) contains an internal temperature sensor (thermistor) that is used by the climate controlled seat module (CCSM) to monitor the temperature of each TED. Based on the temperature of a TED, the internal sensor resistance will vary the voltage on circuit 8-HC23 (WH/BK) (seat cushion TED) and circuit 8-HC16 (WH/RD) (backrest TED).

Possible Causes

An overtemp or differential temperature fault can be caused by:

- wiring, terminals or connectors.
- damaged, restricted or disconnected air ducts.
- worn, damaged or incorrectly installed foam wedge, cushion foam or seat cushion trim cover.
- a restricted seat fan motor filter.
- airflow leaks.
- collapsed airflow channels in the seat cushion foam.
- incorrect installation of a TED.
- TED.
- CCSM.

PINPOINT TEST T: DTC B2729 — CUSHION OVER-TEMP DETECTED/DTC B2730 — BACK OVER-TEMP DETECTED/DTC B2731 — DIFFERENTIAL TEMPERATURE FAULT — DRIVER SEAT

NOTE: The presence of overtemp faults (DTCs B2729, B2730 and B2731) can be induced by incorrect operation of the climate controlled seat system after an initial HEAT setting has been attained. If a HEAT setting is repeatedly turned OFF and ON in an attempt to increase the seat temperature, an overtemp condition can result and the DTC(s) will be set.

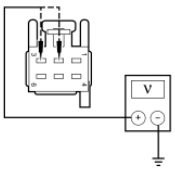
NOTE: A condition may exist where one or both climate controlled seats turn OFF shortly after initialization with CCSM DTC B2729 and/or DTC B2731 present. If this condition is present, check for airflow restrictions due to seat cushion manifold crush or air duct disconnection. If only a stand alone DTC B2731 is present, check for an air duct disconnection between the seat backrest and seat cushion. Proceed with the diagnostic procedure and repair as needed.

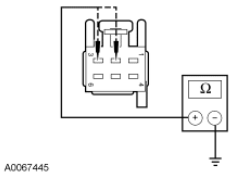
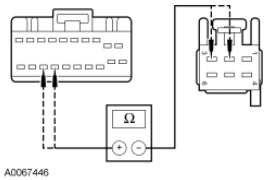
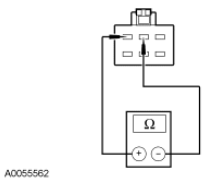
Test Step	Result / Action to Take
T1 CHECK THE SEAT CUSHION TED	

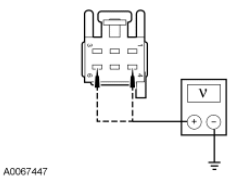
EXHAUST NOZZLE FOR WASTE AIRFLOW	
⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.** **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Ignition ON. • Set both front seats to LOW COOL (1 LED illuminated) at the dual automatic temperature control (DATC) module. • Check for air exhausting from the seat cushion TED exhaust nozzle and compare it to the air exhausting from the opposite seat. • **Is air exhausting from the seat cushion TED exhaust nozzle comparable to the air exhausting from the opposite seat?**	**Yes** GO to T4 . **No** GO to T2 .
T2 INSPECT THE SEAT CUSHION DUCTS	
• Ignition OFF.	**Yes** REPAIR or INSTALL new duct(s) as needed. CLEAR the DTCs. REPEAT the self-test. TEST

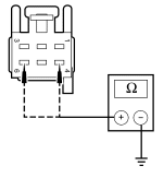
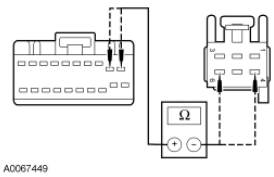
• Inspect the seat cushion ducts for damaged, restricted or disconnected ducts. • **Are any duct(s) damaged, restricted or disconnected?**	the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to T3 .
T3 INSPECT THE SEAT CUSHION TED FOR CORRECT INSTALLATION	
• Ignition OFF. • Inspect the TED for correct installation to the seat cushion. • **Is the seat cushion TED correctly installed?**	**Yes** REMOVE the seat and the seat cushion trim cover. INSPECT for a worn, damaged or incorrectly installed foam wedge, cushion foam or seat cushion trim cover. INSPECT for collapsed airflow channels in the seat cushion foam. REPAIR or INSTALL a new foam wedge, seat cushion foam or seat cushion trim cover as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL the seat cushion TED correctly. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T4 CHECK THE SEAT BACKREST TED EXHAUST NOZZLE FOR WASTE AIRFLOW	
• Set both front seats to LOW COOL (1 LED illuminated) at the dual automatic temperature control (DATC) module. • Check for air exhausting from the seat backrest TED exhaust nozzle and compare it to the air exhausting from the opposite seat. • **Is air exhausting from the seat backrest TED exhaust nozzle comparable to the air**	**Yes** GO to T7 . **No** GO to T5 .

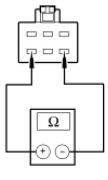
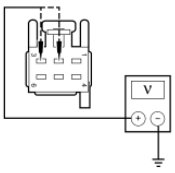
exhausting from the opposite seat?	
T5 INSPECT THE SEAT BACKREST DUCTS	
• Inspect the seat backrest ducts for damaged, restricted or disconnected ducts. • **Are any duct(s) damaged, restricted or disconnected?**	**Yes** REPAIR or INSTALL new duct(s) as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to T6 .
T6 INSPECT THE SEAT BACKREST TED FOR CORRECT INSTALLATION	
• Ignition OFF. • Inspect the TED for correct installation to the seat cushion. • **Is the seat backrest TED correctly installed?**	**Yes** REMOVE the seat and the seat backrest trim cover. INSPECT for a worn, damaged or incorrectly installed foam wedge, backrest foam or seat backrest trim cover. INSPECT for collapsed airflow channels in the seat backrest foam. REPAIR or INSTALL a new foam wedge, seat backrest foam or seat backrest trim cover as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL the seat backrest TED correctly. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T7 CHECK THE SEAT CUSHION AND SEAT BACKREST TEMPERATURE PIDs	
• Enter the following diagnostic mode on the scan tool: CCSM Active Command Menu TED HEAT MODE.	**Yes** If CUSHION THERMAL ELECTRIC DEVICE TED TEMPERATURE PID is greater than 185°F (85°C), GO to T8 .

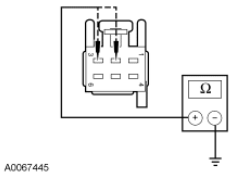
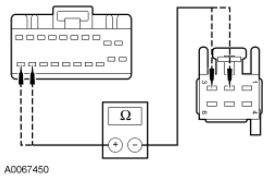
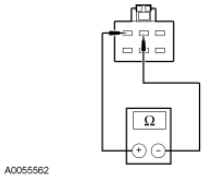
• **NOTE:** After the active command TED HEAT is commanded to the ON state, the climate controlled seat TED will operate for 15 seconds then turn off. • **NOTE:** The CCSM is not the source of the fault if the active command mode is operational. • Monitor the CCSM PIDs CUSHION THERMAL ELECTRIC DEVICE TED TEMPERATURE and BACK THERMAL ELECTRIC DEVICE TED TEMPERATURE while commanding the TED HEAT active command ON. • **Is either PID greater than 185°F (85°C)?**	If BACK THERMAL ELECTRIC DEVICE TED TEMPERATURE PID is greater than 185°F (85°C), GO to T17 . **No** GO to T12 .
T8 CHECK THE SEAT CUSHION TED TEMPERATURE SENSOR CIRCUITS 8-HC23 (WH/BK) AND 9-HC23 (BN/YE) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Driver Seat Cushion TED C3035. • Disconnect: Driver CCSM C3031b. • Ignition ON. • Measure the voltage between driver seat cushion TED C3035-3, circuit 8-HC23 (WH/BK), harness side and ground; and between driver seat cushion TED C3035-2, circuit 9-HC23 (BN/YE), harness side and ground.  A0067444 • **Are the voltages less than 0.2 volt?**	**Yes** GO to T9 . **No** REPAIR the affected circuits. CLEAR the DTCs. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T9 CHECK THE SEAT CUSHION TED TEMPERATURE SENSOR CIRCUITS 8-HC23 (WH/BK) AND 9-HC23 (BN/YE) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between driver seat cushion TED C3035-3, circuit 8-HC23 (WH/BK), harness side and ground; and between driver seat cushion TED C3035-2, circuit 9-HC23 (BN/YE), harness side and ground.	**Yes** GO to T10 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316.

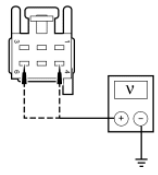
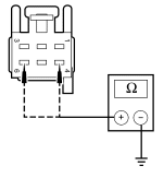
 A0067445 • **Is the resistance greater than 10,000 ohms?**	CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T10 CHECK THE SEAT CUSHION TED TEMPERATURE SENSOR CIRCUITS 8-HC23 (WH/BK) AND 9-HC23 (BN/YE) FOR AN OPEN	
• Measure the resistance between driver seat cushion TED C3035-3, circuit 8-HC23 (WH/BK), harness side and driver CCSM C3031b-18, circuit 8-HC23 (WH/BK), harness side; and between driver seat cushion TED C3035-2, circuit 9-HC23 (BN/YE), harness side and driver CCSM C3031b-17, circuit 9-HC23 (BN/YE), harness side.  A0067446 • **Are the resistances less than 5 ohms?**	**Yes** GO to T11 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T11 CHECK THE SEAT CUSHION TEMPERATURE SENSOR	
• Measure the resistance between seat cushion TED pin 3 and pin 2, component side.  A0055562 • **Is the resistance greater than 1,000 ohms?**	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat cushion TED. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316.

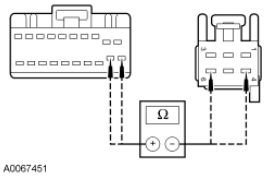
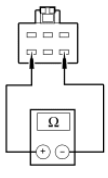
	CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T12 CHECK THE SEAT CUSHION AND SEAT BACKREST TEMPERATURE PIDS	
• Enter the following diagnostic mode on the scan tool: CCSM Active Command Menu TED HEAT MODE. • **NOTE:** After the active command TED HEAT is commanded to the ON state, the climate controlled seat TED will operate for 15 seconds then turn off. • **NOTE:** The CCSM is not the source of the fault if the active command mode is operational. • Monitor the CCSM PIDs CUSHION THERMAL ELECTRIC DEVICE TED TEMPERATURE and BACK THERMAL ELECTRIC DEVICE TED TEMPERATURE while commanding the TED HEAT active command ON. • **Did the PID values change?**	**Yes** REPAIR the climate controlled seat for airflow leaks. INSPECT the fan, TEDs, ducts, foam wedges, foam pads, trim covers and their connection points and REPAIR as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** If CUSHION THERMAL ELECTRIC DEVICE TED TEMPERATURE PID does not change, GO to T13 . If BACK THERMAL ELECTRIC DEVICE TED TEMPERATURE PID does not change, GO to T21 .
T13 CHECK THE SEAT CUSHION TED HEATING ELEMENT CIRCUITS 31S-HC17 (BK/OG) AND 20S-HC17 (PK) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Driver Seat Cushion TED C3035. • Disconnect: Driver CCSM C3031b. • Ignition ON. • Measure the voltage between driver seat cushion TED C3035-4, circuit 31S-HC17 (BK/OG), harness side and ground; and between driver seat cushion TED C3035-6, circuit 20S-HC17 (PK), harness side and ground.  A0067447 • **Are the voltages less than 0.2 volt?**	**Yes** GO to T14 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

T14 CHECK THE SEAT CUSHION TED HEATING ELEMENT CIRCUITS 31S-HC17 (BK/OG) AND 20S-HC17 (PK) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between driver seat cushion TED C3035-4, circuit 31S-HC17 (BK/OG), harness side and ground; and between driver seat cushion TED C3035-6, circuit 20S-HC17 (PK), harness side and ground.  A0067448 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to T15 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T15 CHECK THE SEAT CUSHION TED HEATING ELEMENT CIRCUITS 31S-HC17 (BK/OG) AND 20S-HC17 (PK) FOR AN OPEN	
• Measure the resistance between driver seat cushion TED C3035-4, circuit 31S-HC17 (BK/OG), harness side and driver CCSM C3031b-2, circuit 31S-HC17 (BK/OG), harness side; and between driver seat cushion TED C3035-6, circuit 20S-HC17 (PK), harness side and driver CCSM C3031b-1, circuit 20S-HC17 (PK), harness side.  A0067449 • **Are the resistances less than 5 ohms?**	**Yes** GO to T16 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T16 CHECK THE SEAT CUSHION TED	
• Measure the resistance between the seat cushion TED pin 4 and pin 6, component side.	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable.

 A0055566 • **Is the resistance between 0.5 and 7 ohms?**	DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat cushion TED. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T17 CHECK THE SEAT BACKREST TED TEMPERATURE SENSOR CIRCUITS 8-HC16 (WH/RD) AND 9-HC16 (BN/RD) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Driver Seat Backrest TED C3034. • Disconnect: Driver CCSM C3031b. • Ignition ON. • Measure the voltage between driver seat backrest TED C3034-3, circuit 8-HC16 (WH/RD), harness side and ground; and between driver seat backrest TED C3034-2, circuit 9-HC16 (BN/RD), harness side and ground.  A0067444 • **Are the voltages less than 0.2 volt?**	**Yes** GO to T18 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T18 CHECK THE SEAT BACKREST TED TEMPERATURE SENSOR CIRCUITS 8-HC16 (WH/RD) AND 9-HC16 (BN/RD) FOR A SHORT TO GROUND	
• Measure the resistance between driver seat backrest TED C3034-3, circuit 8-HC16 (WH/RD), harness side and ground; and between driver seat backrest TED C3034-2, circuit 9-HC16 (BN/RD), harness side and ground.	**Yes** GO to T19 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable.

 A0067445 • **Are the resistances greater than 10,000 ohms?**	DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T19 CHECK THE SEAT BACKREST TED TEMPERATURE SENSOR CIRCUITS 8-HC16 (WH/RD) AND 9-HC16 (BN/RD) FOR AN OPEN	
• Measure the resistance between driver seat backrest TED C3034-3, circuit 8-HC16 (WH/RD), harness side and driver CCSM C3031b-9, circuit 8-HC16 (WH/RD), harness side; and between driver seat backrest TED C3034-2, circuit 9-HC16 (BN/RD), harness side and driver CCSM C3031b-20, circuit 9-HC16 (BN/RD), harness side.  A0067450 • **Are the resistances less than 5 ohms?**	**Yes** GO to T20 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T20 CHECK THE SEAT BACKREST TEMPERATURE SENSOR	
• Measure the resistance between the seat backrest TED pin 2 and pin 3, component side.  A0055562 • **Is the resistance greater than 1,000 ohms?**	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat backrest TED. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316.

	CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T21 CHECK THE SEAT BACKREST TED HEATING ELEMENT CIRCUITS 31S-HC16 (BK/BU) AND 20S-HC16 (PK/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Driver Seat Backrest TED C3034. • Disconnect: Driver CCSM C3031b. • Ignition ON. • Measure the voltage between driver seat backrest TED C3034-4, circuit 31S-HC16 (BK/BU), harness side and ground; and between driver seat backrest TED C3034-6, circuit 20S-HC16 (PK/BU), harness side and ground.  A0067447 • **Are the voltages less than 0.2 volt?**	**Yes** GO to T22 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T22 CHECK THE SEAT BACKREST TED HEATING ELEMENT CIRCUITS 31S-HC16 (BK/BU) AND 20S-HC16 (PK/BU) FOR A SHORT TO GROUND	
• Measure the resistance between driver seat backrest TED C3034-4, circuit 31S-HC16 (BK/BU), harness side and ground; and between driver seat backrest TED C3034-6, circuit 20S-HC16 (PK/BU), harness side and ground.  A0067448 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to T23 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T23 CHECK THE SEAT BACKREST TED HEATING ELEMENT CIRCUITS 31S-HC16 (BK/BU) AND 20S-HC16 (PK/BU) FOR AN	

OPEN	
• Measure the resistance between driver seat backrest TED C3034-4, circuit 31S-HC16 (BK/BU), harness side and driver CCSM C3131b-12, circuit 31S-HC16 (BK/BU), harness side; and between driver seat backrest TED C3034-6, circuit 20S-HC16 (PK/BU), harness side and driver CCSM C3131b-11, circuit 20S-HC16 (PK/BU), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to T24 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
T24 CHECK THE SEAT BACKREST TED	
• Measure the resistance between the seat backrest TED pin 4 and pin 6, component side.  • **Is the resistance between 0.5 and 7 ohms?**	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat backrest TED. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316. CONNECT driver seat side air bag module C316. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test U: DTC B2729 — Cushion Over-Temp Detected/DTC B2730 — Back Over-Temp Detected/DTC B2731 — Differential Temperature Fault — Passenger Seat

Normal Operation

Each thermo-electric device (TED) contains an internal temperature sensor (thermistor) that is used by the climate controlled seat module (CCSM) to monitor the temperature of each (TED). Based on the temperature

of a TED, the internal sensor resistance will vary the voltage on circuit 8-HC24 (WH/RD) (seat cushion TED) and circuit 8-HC19 (WH/BK) (backrest TED).

Possible Causes

An overtemp or differential temperature fault can be caused by:

- wiring, terminals or connectors.
- damaged, restricted or disconnected air ducts.
- worn, damaged or incorrectly installed foam wedge, cushion foam or seat cushion trim cover.
- a restricted seat fan motor filter.
- airflow leaks.
- collapsed airflow channels in the seat cushion foam.
- incorrect installation of a TED.
- TED.
- CCSM.

PINPOINT TEST U: DTC B2729 — CUSHION OVER-TEMP DETECTED/DTC B2730 — BACK OVER-TEMP DETECTED/DTC B2731 — DIFFERENTIAL TEMPERATURE FAULT — PASSENGER SEAT

NOTE: The presence of overtemp faults (DTCs B2729, B2730 and B2731) can be induced by incorrect operation of the climate controlled seat system after an initial HEAT setting has been attained. If a HEAT setting is repeatedly turned OFF and ON in an attempt to increase the seat temperature, an overtemp condition can result and the DTC(s) will be set.

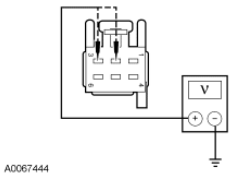
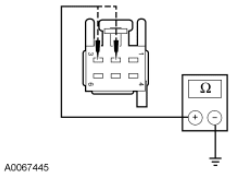
NOTE: A condition may exist where one or both climate controlled seats turn OFF shortly after initialization with CCSM DTC B2729 and/or DTC B2731 present. If this condition is present, check for airflow restrictions due to seat cushion manifold crush or air duct disconnection. If only a stand alone DTC B2731 is present, check for an air duct disconnection between the seat backrest and seat cushion. Proceed with the diagnostic procedure and repair as needed.

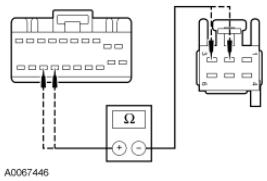
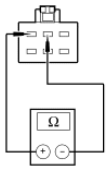
Test Step	Result / Action to Take
U1 CHECK THE SEAT CUSHION TED EXHAUST NOZZLE FOR WASTE AIRFLOW	
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards. **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.	**Yes** GO to U4 . **No** GO to U2 .

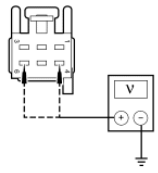
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Passenger Seat Side Air Bag Module C314. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Passenger Seat Side Air Bag Module C314. • Connect: Battery Ground Cable. • ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Ignition ON. • Set both front seats to the LOW COOL (1 LED illuminated) at the dual automatic temperature control (DATC) module. • Check for air exhausting from the seat cushion TED exhaust nozzle and compare it to the air exhausting from the opposite seat. • **Is air exhausting from the seat cushion TED exhaust nozzle comparable to the air exhausting from the opposite seat?**	
U2 INSPECT THE SEAT CUSHION DUCTS	
• Ignition OFF. • Inspect the seat cushion ducts for damaged, restricted or disconnected ducts. • **Are any duct(s) damaged, restricted or disconnected?**	**Yes** REPAIR or INSTALL new duct(s) as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to U3 .
U3 INSPECT THE SEAT CUSHION TED FOR CORRECT INSTALLATION	
• Inspect the TED for correct installation to the seat cushion. • **Is the seat cushion TED correctly installed?**	**Yes** REMOVE the seat and the seat cushion trim cover. INSPECT for a worn, damaged or incorrectly installed foam wedge, cushion foam or seat cushion trim cover. INSPECT for collapsed airflow channels in the seat cushion foam.

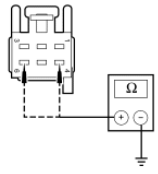
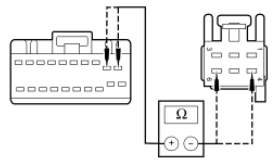
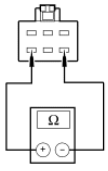
	REPAIR or INSTALL a new foam wedge, seat cushion foam or seat cushion trim cover as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL the seat cushion TED correctly. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U4 CHECK THE SEAT BACKREST TED EXHAUST NOZZLE FOR WASTE AIRFLOW	
• Set both front seats to LOW COOL (1 LED illuminated) at the dual automatic temperature control (DATC) module. • Check for air exhausting from the seat backrest TED exhaust nozzle and compare it to the air exhausting from the opposite seat. • **Is air exhausting from the seat backrest TED exhaust nozzle comparable to the air exhausting from the opposite seat?**	**Yes** GO to U7 . **No** GO to U5 .
U5 INSPECT THE SEAT BACKREST DUCTS	
• Inspect the seat backrest ducts for damaged, restricted or disconnected ducts. • **Are any duct(s) damaged, restricted or disconnected?**	**Yes** REPAIR or INSTALL new duct(s) as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to U6 .
U6 INSPECT THE SEAT BACKREST TED FOR CORRECT INSTALLATION	

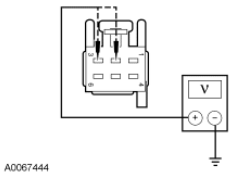
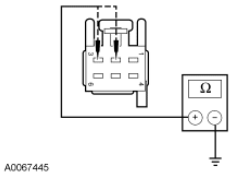
• Inspect the TED for correct installation to the seat cushion. • **Is the seat backrest TED correctly installed?**	**Yes** REMOVE the seat and the seat backrest trim cover. INSPECT for a worn, damaged or incorrectly installed foam wedge, backrest foam or seat backrest trim cover. INSPECT for collapsed airflow channels in the seat backrest foam. REPAIR or INSTALL a new foam wedge, seat backrest foam or seat backrest trim cover as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL the seat backrest TED correctly. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U7 CHECK THE SEAT CUSHION AND SEAT BACKREST TEMPERATURE PIDS	
• Enter the following diagnostic mode on the scan tool: CCSM Active Command Menu TED HEAT MODE. • **NOTE:** After the active command TED HEAT is commanded to the ON state, the climate controlled seat TED will operate for 15 seconds then turn off. • **NOTE:** The CCSM is not the source of the fault if the active command mode is operational. • Monitor the CCSM PIDs CUSHION THERMAL ELECTRIC DEVICE TED TEMPERATURE and BACK THERMAL ELECTRIC DEVICE TED TEMPERATURE while commanding the TED HEAT active command ON. • **Is either PID greater than 185°F (85°C)?**	**Yes** If CUSHION THERMAL ELECTRIC DEVICE TED TEMPERATURE PID is greater than 185°F (85°C), GO to U8 . If BACK THERMAL ELECTRIC DEVICE TED TEMPERATURE PID is greater than 185°F (85°C), GO to U17 . **No** GO to U12 .
U8 CHECK THE SEAT CUSHION TED TEMPERATURE SENSOR CIRCUITS 8-HC24 (WH/RD) AND 9-HC24 (BN/RD) FOR A SHORT TO VOLTAGE	

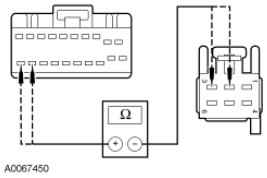
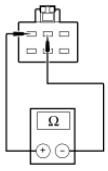
• Ignition OFF. • Disconnect: Passenger Seat Cushion TED C3040. • Disconnect: Passenger CCSM C3036b. • Ignition ON. • Measure the voltage between passenger seat cushion TED C3040-3, circuit 8-HC24 (WH/RD), harness side and ground; and between passenger seat cushion TED C3040-2, circuit 9-HC24 (BN/RD), harness side and ground.  A0067444 • **Are the voltages less than 0.2 volt?**	**Yes** GO to U9 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U9 CHECK THE SEAT CUSHION TED TEMPERATURE SENSOR CIRCUITS 8-HC24 (WH/RD) AND 9-HC24 (BN/RD) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between passenger seat cushion TED C3040-3, circuit 8-HC24 (WH/RD), harness side and ground; and between passenger seat cushion TED C3040-2, circuit 9-HC24 (BN/RD), harness side and ground.  A0067445 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to U10 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U10 CHECK THE SEAT CUSHION TED TEMPERATURE SENSOR CIRCUITS 8-HC24 (WH/RD) AND 9-HC24 (BN/RD) FOR AN OPEN	
• Measure the resistance between passenger seat cushion TED C3040-3, circuit 8-HC24 (WH/RD), harness side and passenger CCSM C3036b-18, circuit 8-HC24 (WH/RD), harness side; and between passenger seat cushion TED C3040-2, circuit 9-HC24 (BN/RD), harness side and passenger CCSM	**Yes** GO to U11 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable.

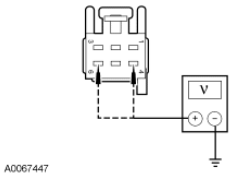
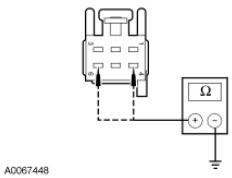
C3036b-17, circuit 9-HC24 (BN/RD), harness side.  A0067446 • **Are the resistances less than 5 ohms?**	DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U11 CHECK THE SEAT CUSHION TEMPERATURE SENSOR	
• Measure the resistance between the seat cushion TED pin 3 and pin 2, component side.  A0055562 • **Is the resistance greater than 1,000 ohms?**	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat cushion TED. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U12 CHECK THE SEAT CUSHION AND SEAT BACKREST TEMPERATURE PIDS	
• Enter the following diagnostic mode on the scan tool: CCSM Active Command Menu TED HEAT MODE. • **NOTE:** After the active command TED HEAT is commanded to the ON state, the climate controlled seat TED will operate for 15 seconds then turn off. • **NOTE:** The CCSM is not the source of the fault if the active command mode is operational. • Monitor the CCSM PIDs CUSHION THERMAL ELECTRIC DEVICE TED	**Yes** REPAIR the climate controlled seat for airflow leaks. INSPECT the fan, TEDs, ducts, foam wedges, foam pads, trim covers and their connection points and REPAIR as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section

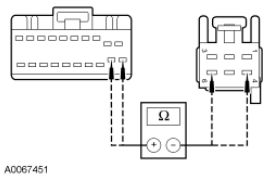
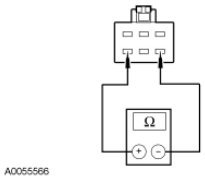
TEMPERATURE and BACK THERMAL ELECTRIC DEVICE TED TEMPERATURE while commanding the TED HEAT active command ON. • **Did the PID values change?**	501-20B . **No** If CUSHION THERMAL ELECTRIC DEVICE TED TEMPERATURE PID does not change, GO to U13 . If BACK THERMAL ELECTRIC DEVICE TED TEMPERATURE PID does not change, GO to U21 .
U13 CHECK THE SEAT CUSHION TED HEATING ELEMENT CIRCUITS 31S-HC20 (BK/WH) AND 20S-HC20 (PK/WH) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Passenger Seat Cushion TED C3040. • Disconnect: Passenger CCSM C3036b. • Ignition ON. • Measure the voltage between passenger seat cushion TED C3040-4, circuit 31S-HC20 (BK/WH), harness side and ground; and between passenger seat cushion TED C3040-6, circuit 20S-HC20 (PK/WH), harness side and ground.  A0067447 • **Are the voltages less than 0.2 volt?**	**Yes** GO to U14 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U14 CHECK THE SEAT CUSHION TED HEATING ELEMENT CIRCUITS 31S-HC20 (BK/WH) AND 20S-HC20 (PK/WH) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between passenger seat cushion TED C3040-4, circuit 31S-HC20 (BK/WH), harness side and ground; and between passenger seat cushion TED C3040-6, circuit 20S-HC20 (PK/WH), harness side and ground.	**Yes** GO to U15 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

 A0067448 • **Are the resistances greater than 10,000 ohms?**	
U15 CHECK THE SEAT CUSHION TED HEATING ELEMENT CIRCUITS 31S-HC20 (BK/WH) AND 20S-HC20 (PK/WH) FOR AN OPEN	
• Measure the resistance between passenger seat cushion TED C3040-4, circuit 31S-HC20 (BK/WH), harness side and passenger CCSM C3036b-2, circuit 31S-HC20 (BK/WH), harness side; and between passenger seat cushion TED C3040-6, circuit 20S-HC20 (PK/WH), harness side and passenger CCSM C3036b-1, circuit 20S-HC20 (PK/WH), harness side.  A0067449 • **Are the resistances less than 5 ohms?**	**Yes** GO to U16 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U16 CHECK THE SEAT CUSHION TED	
• Measure the resistance between the seat cushion TED pin 4 and pin 6, component side.  A0055566 • **Is the resistance between 0.5 and 7 ohms?**	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. REACTIVATE the supplemental restraint system (SRS). TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat cushion TED. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module

	C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U17 CHECK THE SEAT BACKREST TED TEMPERATURE SENSOR CIRCUITS 8-HC19 (WH/BK) AND 9-HC19 (BN/YE) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Passenger Seat Backrest TED C3039. • Disconnect: Passenger CCSM C3036b. • Ignition ON. • Measure the voltage between passenger seat backrest TED C3039-3, circuit 8-HC19 (WH/BK), harness side and ground; and between passenger seat backrest TED C3039-2, circuit 9-HC19 (BN/YE), harness side and ground.  A0067444 • **Are the voltages less than 0.2 volt?**	**Yes** GO to U18 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U18 CHECK THE SEAT BACKREST TED TEMPERATURE SENSOR CIRCUITS 8-HC19 (WH/BK) AND 9-HC19 (BN/YE) FOR A SHORT TO GROUND	
• Measure the resistance between passenger seat backrest TED C3039-3, circuit 8-HC19 (WH/BK), harness side and ground; and between passenger seat backrest TED C3039-2, circuit 9-HC19 (BN/YE), harness side and ground.  A0067445 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to U19 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U19 CHECK THE SEAT BACKREST TED TEMPERATURE SENSOR CIRCUITS 8-HC19	

(WH/BK) AND 9-HC19 (BN/YE) FOR AN OPEN	
• Measure the resistance between passenger seat backrest TED C3039-3, circuit 8-HC19 (WH/BK), harness side and passenger CCSM C3036b-19, circuit 8-HC19 (WH/BK), harness side; and between passenger seat backrest TED C3039-2, circuit 9-HC19 (BN/YE), harness side and passenger CCSM C3036b-20, circuit 9-HC19 (BN/YE), harness side.  A0067450 • **Are the resistances less than 5 ohms?**	**Yes** GO to U20 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U20 CHECK THE SEAT BACKREST TEMPERATURE SENSOR	
• Measure the resistance between the seat backrest TED pin 2 and pin 3, component side.  A0055562 • **Is the resistance greater than 1,000 ohms?**	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat backrest TED. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U21 CHECK THE SEAT BACKREST TED HEATING ELEMENT CIRCUITS 31S-HC19 (BK/RD) AND 20S-HC19 (PK/OG) FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Disconnect: Passenger Seat Backrest TED C3039. • Disconnect: Passenger CCSM C3036b. • Ignition ON. • Measure the voltage between passenger seat backrest TED C3039-4, circuit 31S-HC19 (BK/RD), harness side and ground; and between passenger seat backrest TED C3039-6, circuit 20S-HC19 (PK/OG), harness side and ground.  A0067447 • **Are the voltages less than 0.2 volt?**	**Yes** GO to U22 . **No** REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U22 CHECK THE SEAT BACKREST TED HEATING ELEMENT CIRCUITS 31S-HC19 (BK/RD) AND 20S-HC19 (PK/OG) FOR A SHORT TO GROUND	
• Measure the resistance between passenger seat backrest TED C3039-4, circuit 31S-HC19 (BK/RD), harness side and ground; and between passenger seat backrest TED C3039-6, circuit 20S-HC19 (PK/OG), harness side and ground.  A0067448 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to U23 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U23 CHECK THE SEAT BACKREST TED HEATING ELEMENT CIRCUITS 31S-HC19 (BK/RD) AND 20S-HC19 (PK/OG) FOR AN OPEN	
• Measure the resistance between passenger seat backrest TED C3039-4, circuit 31S-HC19 (BK/RD), harness side and passenger CCSM C3036b-12, circuit 31S-HC19 (BK/RD), harness side; and between passenger seat backrest TED C3039-6, circuit 20S-HC19 (PK/OG),	**Yes** GO to U24 . **No** REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable.

harness side and passenger CCSM C3036b-11, circuit 20S-HC19 (PK/OG), harness side.  A0067451 • **Are the resistances less than 5 ohms?**	DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
U24 CHECK THE SEAT BACKREST TED	
• Measure the resistance between the seat backrest TED pin 4 and pin 6, component side.  A0055566 • **Is the resistance between 0.5 and 7 ohms?**	**Yes** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new seat backrest TED. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from passenger seat side air bag module C314. CONNECT passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Pinpoint Test V: A Single Climate Controlled Seat Does Not Operate/Does Not Operate Correctly

Normal Operation

The climate controlled seat module (CCSM) controls are incorporated into the dual automatic temperature control (DATC) module. The DATC module communicates with the CCSM via the UBP bus.

Possible Causes

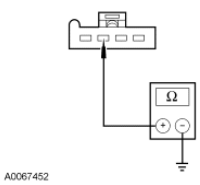
A climate controlled seat that does not operate or does not operate correctly can be caused by:

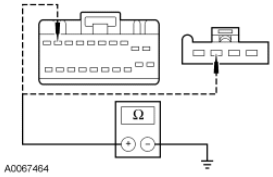
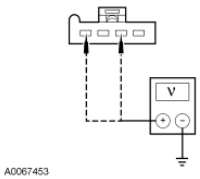
- fuse(s).
- wiring, terminals or connectors.
- UBP network communication fault.

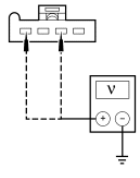
- DATC module.
- CCSM.

PINPOINT TEST V: A SINGLE CLIMATE CONTROLLED SEAT DOES NOT OPERATE/DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
V1 CHECK FOR CCSM DTCS	
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards. **NOTE:** If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.** Refer to Section 501-20B . **NOTE:** The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Restraint System Diagnostic Tool 418-133 or 501-097 to Driver Seat Side Air Bag Module C316 or Passenger Seat Side Air Bag Module C314. • Connect: Battery Ground Cable.	**Yes** GO to the Climate Controlled Seat Module (CCSM) Diagnostic Trouble Code (DTC) Index. **No** If the diagnostic tool communicates with the CCSM, GO to V2 . If the diagnostic tool does not communicate with the CCSM, GO to V3 .

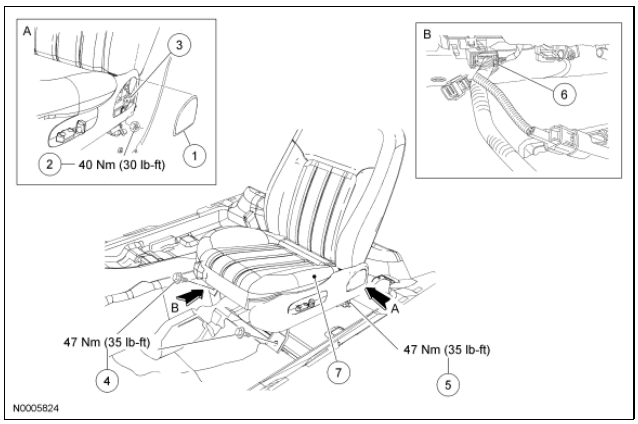
• ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.** • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Were any DTCs retrieved?**	
V2 CHECK FOR DATC MODULE DTCS	
• Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Were any DTCs retrieved?**	**Yes** GO to Section 412-00 . **No** If the diagnostic tool communicates with the DATC module, GO to V5 . If the diagnostic tool does not communicate with the DATC module, GO to Section 418-00 to diagnose the module communications network concern. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .
V3 CHECK CIRCUIT 31-HC21 (BK/GN) OR CIRCUIT 31-HC22 (BK/YE)	
• Ignition OFF. • Disconnect: Driver CCSM C3031a or Passenger CCSM C3036a. • For a driver seat, measure the resistance between driver CCSM C3031a-3, circuit 31-HC21 (BK/GN), harness side and ground.  A0067452 • **NOTE:** Passenger CCSM C3036b-9, circuit 31-HC22D (BK/YE) is used to identify the CCSM as the passenger side	**Yes** GO to V4 . **No** REPAIR the affected circuit. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

module. If a fault is present on circuit 31-HC22D (BK/YE), the passenger CCSM may operate when the driver CCSM operation is requested by the DATC module settings. • For a passenger seat, measure the resistance between passenger CCSM C3036a-3, circuit 31-HC22 (BK/YE), harness side and ground; and between passenger CCSM C3036b-9, circuit 31-HC22D (BK/YE), harness side and ground.  • **Is the resistance less than 5 ohms?**	
V4 CHECK THE CCSM VOLTAGE	
• Ignition ON. • For driver CCSM, measure the voltage between driver CCSM C3031a-2, circuit 20-HC21 (PK/BK), harness side and ground; and between driver CCSM C3131a-4, circuit 30-HC21 (RD/GN), harness side and ground.  • For passenger CCSM, measure the voltage between passenger CCSM C3036a-2, circuit 20S-HC22 (PK/YE), harness side and ground; and between passenger CCSM C3036a-4, circuit 30-HC22 (RD/YE), harness side and ground.	**Yes** GO to Section 418-00 to diagnose the module communications network concern. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** VERIFY battery junction box (BJB) fuse 26 (30A) and central junction box (CJB) fuse 16 (5A) are OK. If OK, REPAIR the affected circuit. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

 A0067453 • **Are the voltages greater than 10 volts?**	
V5 CHECK THE DATC MODULE-TO-CCSM COMMUNICATION	
• Ignition OFF. • Connect: Driver CCSM C3031a or Passenger CCSM C3036a. • Ignition ON. • Enter the following diagnostic mode on the scan tool: CCSM PID DATC STATE ENCODED SEAT MODE. • Monitor the CCSM PID DATC STATE ENCODED SEAT MODE with the DATC module placed in the following climate controlled seat settings: ♦ high heat (press HEAT button, 3 LEDs illuminated). ♦ medium heat (press HEAT button, 2 LEDs illuminated). ♦ low heat (press HEAT button, 1 LED illuminated). ♦ high cool (press COOL button, 3 LEDs illuminated). ♦ medium cool (press COOL button, 2 LEDs illuminated). ♦ low cool (press COOL button, 1 LED illuminated). ♦ AUTO mode (press COOL and HEAT buttons simultaneously, center LED only illuminated). • **Does the CCSM PID match the DATC module setting?**	**Yes** The climate controlled seat system is operating correctly. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** GO to V6 .
V6 CHECK THE CCSM	
• Enter the following diagnostic mode on the scan tool: CCSM Active Command THERMAL ELECTRIC DEVICE HEAT MODE. • Enter the following diagnostic mode on the scan tool: CCSM PID DATC	**Yes** INSTALL a new DATC module. TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or

STATE ENCODED SEAT MODE. • **NOTE:** After the active command THERMAL ELECTRIC DEVICE HEAT MODE is commanded to the ON state, the TED will operate for 15 seconds then turn off. • **NOTE:** The CCSM is not the source of the fault if the active command mode is operational. • Monitor the CCSM PID DATC STATE ENCODED SEAT MODE while commanding the THERMAL ELECTRIC DEVICE HEAT MODE active command ON then OFF. • **Does the CCSM go into HEAT mode?**	passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B . **No** INSTALL a new CCSM and CARRY OUT programmable module installation (PMI). REFER to Climate Controlled Seat Module . TEST the system for normal operation. TURN the ignition OFF. DISCONNECT the battery ground cable. DISCONNECT the restraint system diagnostic tool from driver seat side air bag module C316 or passenger seat side air bag module C314. CONNECT driver seat side air bag module C316 or passenger seat side air bag module C314. REPOWER the supplemental restraint system (SRS). REFER to Section 501-20B .

Seat — Front



Item	Part Number	Description
1	619C10	Safety belt anchor cover
2	N800937-S193	Safety belt anchor nut
3	611B08 RH/ 611B09 LH	Safety belt and anchor
4	W503942-S424	Seat track-to-floor front bolts and washers (2 required)
5	W503942-S424	Seat track-to-floor rear bolt and washer (2 required)
6	14C719	Electrical connector
7	60005 LH/ 60006 RH	Front seat

Removal

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: If a side air bag deployment took place, a new backrest foam pad, trim cover and side air bag module

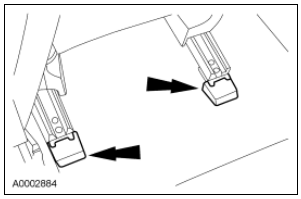
must be installed. A new backrest frame should be installed if necessary.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

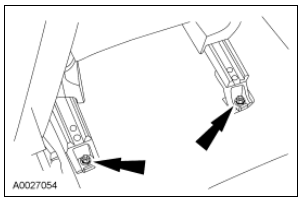
NOTE: Driver seat shown, passenger seat similar.

1. Move the seat fully forward.
2. Remove the safety belt anchor cover.
3. Remove the nut and detach the safety belt anchor.
4. Remove the 2 seat track-to-floor covers.



5. **NOTE:** Original fasteners must be discarded and new service fasteners installed. Service fasteners can be reused.

   Remove the 2 seat track-to-floor rear bolts and washers and discard.



6. Move the seat fully rearward.
7. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .
8. **NOTE:** Original fasteners must be discarded and new service fasteners installed. Service fasteners can be reused.

   Remove the 2 seat track-to-floor front bolts and washers and discard.

9. Disconnect the seat electrical connectors and remove the seat.

Installation

1. Position the seat in the vehicle and connect the seat electrical connectors.
2. **NOTE:** Original fasteners must be discarded and new service fasteners installed. Service fasteners can be reused.

   Install 2 new seat track-to-floor front bolts and washers.

- Tighten to 47 Nm (35 lb-ft).

3. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

4. Move the seat fully forward.

5. **NOTE:** Original fasteners must be discarded and new service fasteners installed. Service fasteners can be reused.

   Install 2 new seat track-to-floor rear bolts and washers.

   - Tighten to 47 Nm (35 lb-ft).

6. Install the 2 seat track-to-floor covers.

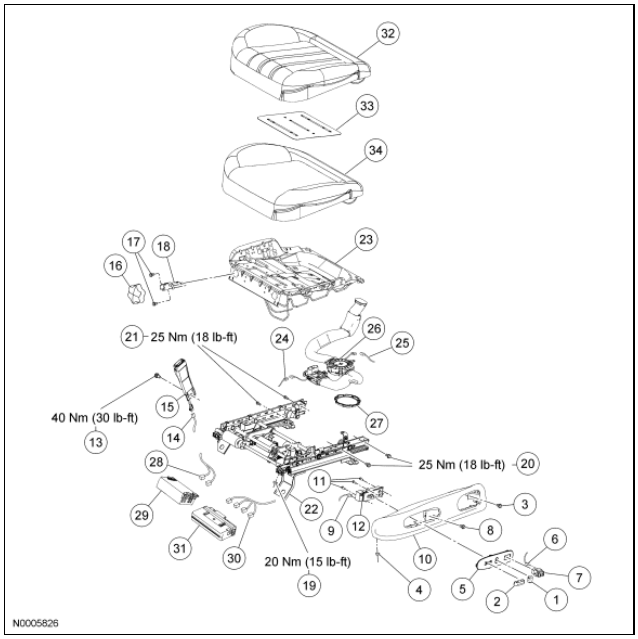
7. Position the safety belt anchor to the seat and install the nut.
   - Tighten to 40 Nm (30 lb-ft).

8. Install the safety belt anchor cover.

9. Check the active restraint system for correct operation. For additional information, refer to Section 501-20A .

Seat — Exploded View, Front

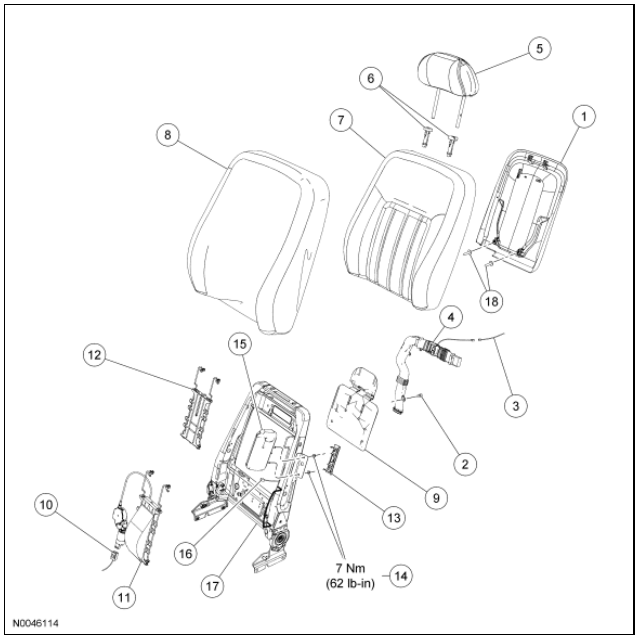
Front Seat Cushion



Item	Part Number	Description
1	14711	Seat control switch knob
2	14711	Seat control switch knob
3	56902-S	Side shield screw
4	56902-S	Side shield screw
5	14A706	Seat control switch bezel
6	14B719	Power lumbar switch electrical connector (if equipped)
7	14C723	Power lumbar switch (if equipped)
8	56902-S	Side shield screw
9	14B719	Seat control switch electrical connector
10	62185	Side shield
11	56902-S	Seat control switch screws
12	14A701	Power seat switch
13	18495	Safety belt buckle bolt
14	14B719	Connector
15	61203	Safety belt buckle
16	610A76	Manual lumbar knob (if equipped)
17	14C719	Manual lumbar adjuster screws (if equipped)
18	61203	Manual lumbar adjuster (if equipped)

19	N620482-S	Power seat track nut
20	009560	Backrest-to-seat track bolts
21	009560	Backrest-to-seat track bolts
22	61701	Power seat track
23	60327	Seat cushion pan
24	14C719 LH/ 14A699 RH	Cushion thermo-electric device electrical connector (if equipped)
25	14C719 LH/ 14A699 RH	Seat fan electrical connector (if equipped)
26	19N550	Blower assembly, ventilation air—lower
27	19E880	Blower assembly filter
28	14C719 LH/ 14A699 RH	Climate controlled seat module electrical connector (if equipped)
29	14C724	Climate controlled seat module (if equipped)
30	14C719 LH/ 14A699 RH	Driver seat module electrical connector (if equipped)
31	14C708	Driver seat module (if equipped)
32	62900	Cushion trim cover
33	19N550	Climate controlled seat cushion duct (if equipped)
34	632A22	Cushion foam pad

Front Seat Backrest



Item	Part Number	Description
1	60762	Backrest trim panel
2	807452	Pin-type retainer (if equipped)

3	14C719 LH/ 14A699 RH	Connector (if equipped)
4	19N550	Blower assembly, ventilation air—upper
5	611A09	Head restraint
6	610A16	Head restraint guide sleeves
7	64416	Backrest trim cover
8	64810	Backrest foam pad
9	19N550	Climate controlled seat backrest cushion duct (if equipped)
10	14C719 LH/ 14A699 RH	Connector (if equipped)
11	65500	Power lumbar assembly (if equipped)
12	65501	Manual lumbar assembly (if equipped)
13	009036	Seat side air bag nut cover
14	N620480-S	Seat side air bag nuts
15	11791	Seat side air bag module
15	611D10	Thorax side air bag module
16	14K155	Connector
17	61019	Backrest frame
18	W709782-S	Pin-type retainers (2 required)

1. For additional information, refer to the procedures in this section.

Climate Controlled Seat Module

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: When installing a new climate control seat module (CCSM), it is necessary to carry out programmable module installation (PMI). For additional information, refer to Section 418-01 .

1. Before removing the CCSM, carry out the appropriate steps in the PMI procedure. For additional information, refer to Section 418-01 .

2. Remove the front seat and depower the SRS. For additional information, refer to Seat — Front in this section.

3. Disconnect the climate controlled seat module electrical connectors.

4. Remove the climate controlled seat module from the seat cushion.

5. To install, reverse the removal procedure.
   - The climate controlled seat module must be configured when a new module is installed. For additional information, refer to Section 418-01 .

6. Install the front seat and repower the SRS. For additional information, refer to Seat — Front in this section.

7. Install the CCSM software data. Carry out the appropriate steps in the PMI procedure. For additional information, refer to Section 418-01 .

Seat Backrest — Front

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat backrest shown, passenger seat backrest similar.

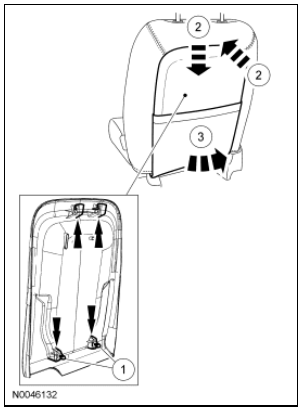
All seats

1. Remove the front seat and depower the SRS. For additional information, refer to Seat — Front in this section.

2. **⚠ CAUTION: The backrest trim panel must be inspected for cracked or broken upper hooks and lower retainer bosses. Remove and discard the lower pin-type retainers before inspecting the lower trim panel bosses. If any hook or boss is damaged a new backrest trim panel must be installed. Always install new pin-type retainers when installing a backrest trim panel.**

   Remove the seat backrest trim panel.

   1. Use an appropriate tool to release the 2 pin-type retainers at the lower bosses of the backrest trim panel.
   2. Push forward on the top of the backrest panel and slide it downward to release the upper hooks.
   3. Continue to push forward on the top of the backrest trim panel while rotating the bottom a few inches rearward to disengage the upper hook barbs.

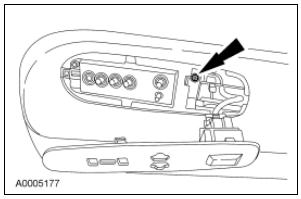


3. Carefully remove the seat control switch knobs.

4. Remove the front and rear side shield screws.

5. Detach and remove the seat control switch bezel.
    - If equipped, disconnect the power lumbar switch.

6. Remove the screw from behind the seat control switch bezel.



7. Disconnect the seat control switch electrical connector and remove the side shield.

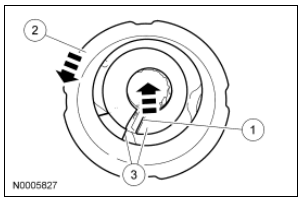
8. Disconnect the electrical connector and remove the safety belt buckle.
    - To install, tighten to 40 Nm (30 lb-ft).

Seats with manual lumbar

9. Remove the manual lumbar knob.

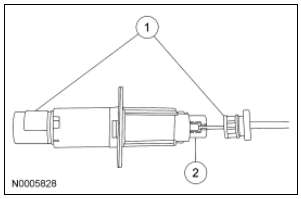
10. Remove the 2 manual lumbar adjuster screws from the seat cushion pan.

11. Release the manual lumbar adjustment screw.
    1. From inside the lumbar adjustment mechanism, push the screw stop in toward the center.
    2. While pushing the screw stop toward the center, rotate the lumbar adjustment mechanism counterclockwise.
    3. The screw stop will pass clear of the internal stop, releasing the manual lumbar adjustment screw.



12. Remove the manual lumbar cable.

1. Continue turning the manual lumbar mechanism counterclockwise until the cable support comes out.
2. Push the screw out enough to remove the cable end.



13. Route the manual lumbar adjuster cable out from the seat cushion frame.

Climate controlled seats

14. Detach the ventilation air — upper blower assembly from the ventilation air — lower blower assembly.

All seats

15. Remove the rear inboard trim cover from the seat track to access the inboard backrest bolts.
    - Remove the screw and detach the pin-type retainer.

16. Remove the 4 backrest-to-seat track bolts and remove the backrest.
    - Disconnect and detach any electrical connectors as needed.
    - To install, tighten to 25 Nm (18 lb-ft).

17. To install, reverse the removal procedure.
    - For backrest trim panel installation:
        - Position the top of the backrest trim panel at an angle to the backrest frame and push it forward and slide it upward to engage the upper hooks.
        - Continue positioning the backrest trim panel upward and align the 2 lower pin-type retainers with the holes in the backrest frame.
        - Push the bottom of the backrest trim panel forward and seat the 2 pin-type retainers.

18. Install the front seat and repower the SRS. For additional information, refer to Seat — Front in this section.

Seat Backrest Cover — Front

Removal

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced (cleaning is permissible).

⚠ WARNING: Side air bag modules with damaged covers must be replaced.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a side air bag deployment took place, the backrest foam pad, trim cover and side air bag module must be replaced. The backrest frame should be replaced if necessary.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat shown, passenger seat similar.

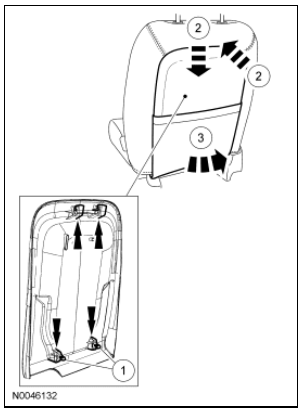
NOTE: A seat side air bag module is shown, a seat side thorax air bag module is similar. For additional information, refer to Section 501-20B in the Description and Operation portion of the section.

1. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

2. **⚠ CAUTION: The backrest trim panel must be inspected for cracked or broken upper hooks and lower retainer bosses. Remove and discard the lower pin-type retainers before inspecting the lower trim panel bosses. If any hook or boss is damaged a new backrest trim panel must be installed. Always install new pin-type retainers when installing a backrest trim panel.**

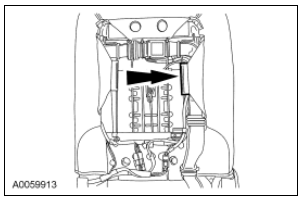
Remove the seat backrest trim panel.

1. Use an appropriate tool to release the 2 pin-type retainers at the lower bosses of the backrest trim panel.
2. Push forward on the top of the backrest panel and slide it downward to release the upper hooks.
3. Continue to push forward on the top of the backrest trim panel while rotating the bottom a few inches rearward to disengage the upper hook barbs.



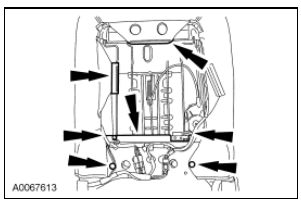
3. Remove the head restraint.

4. Release the trim cover J-clip.

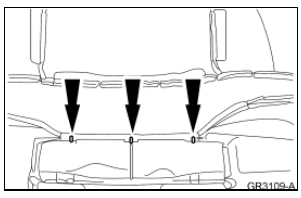


5. If equipped, remove the pin-type retainer and the ventilation air — upper blower assembly.

6. Detach all the backrest trim cover J-clips and the pin-type retainers.
   - Detach the electrical connector(s) near the bottom of the backrest.



7. Partially remove the backrest trim cover to access the hog rings and remove and discard the hog rings.

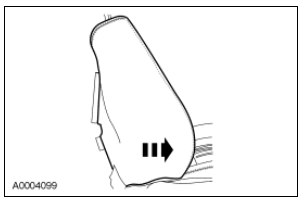


8. Remove the seat side air bag module nut cover.

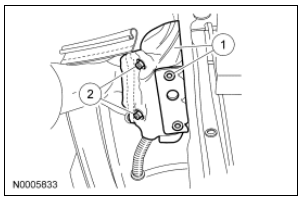
9. **NOTE:** If installing a new side air bag module, use new retaining nuts. If the same side air bag module is to be reused then reuse the side air bag module nuts.

   Remove the 2 seat side air bag module nuts from the backrest frame.

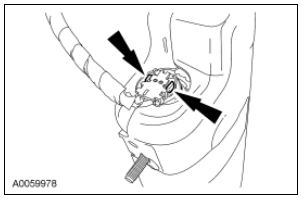
10. With one hand on the seat side air bag module, position the backrest trim cover and foam pad forward enough to access the seat side air bag module.



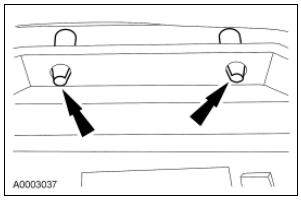
11. Remove the seat side air bag module from the deployment chute.
    1. Separate the seat side air bag module and deployment chute from the backrest frame mounting bracket.
    2. Pull the seat side air bag module mounting studs back through the deployment chute openings and remove the seat side air bag module from the deployment chute.



12. Squeeze the tabs together, disconnect and remove the seat side air bag module.



13. Pinch the end of the head restraint guide sleeves and remove.



14. Remove the backrest trim cover.

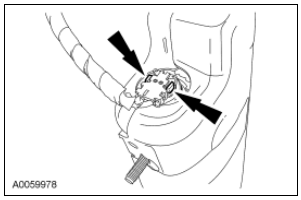
Installation

1. Position the backrest trim cover to the backrest frame and install the head restraint guide sleeves.
   - Position the seat side air bag module deployment chute through the opening in the backrest foam pad.

2. ⚠ **CAUTION: Make sure the correct seat mounted air bag module is being used. The seat side air bag module and the seat side thorax air bag module electrical connectors are unique and will not interchange. Match the electrical connector key to the keyway in the air bag module. Do not**

alter or force the electrical connector into the seat mounted air bag module. For additional information, refer to Section 501-20B in the Description and Operation portion of the section.

Match the electrical connector key to the keyway and connect the seat side air bag module or seat side thorax air bag module.



3. **⚠ WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.**

   ⚠ WARNING: Inspect the side air bag deployment chute and the side air bag cavity in the seat back pad for any foreign objects. If any foreign objects are found remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

   ⚠ WARNING: Before installing the side air bag module into the deployment chute, check it for damage and foreign objects. If the air bag module is damaged, replace it. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

   ⚠ WARNING: If the air bag cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment.

   ⚠ WARNING: Check the side air bag deployment chute for damage. The deployment chute must not be repaired. If there is any damage to the deployment chute, the seat back trim cover and deployment chute must be installed new as a unit.

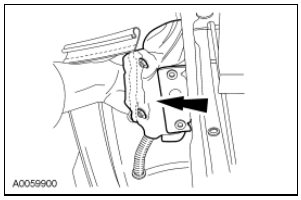
   ⚠ WARNING: If the air bag deployment chute is not properly positioned, the side air bag may not deploy properly.

   ⚠ WARNING: Inspect the mounting surfaces of the deployment chute and the seat back frame mounting bracket for any foreign objects, before installing the side air bag module/deployment chute assembly. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

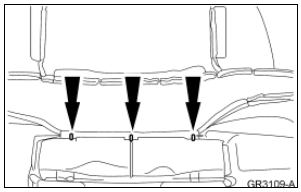
   NOTE: The alignment pin will only allow the seat side air bag module to be installed to the seat back mounting bracket one way.

   Position the seat side air bag module into the deployment chute.

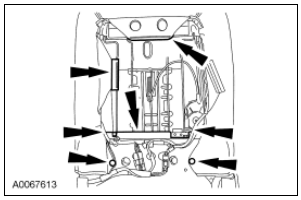
   - Position the seat side air bag module into the deployment chute with the alignment pin offset to the top and the electrical connector to the bottom of the backrest. This will position the alignment pin correctly when the seat side air bag module and deployment chute are mounted to the backrest frame mounting bracket.
   - The seat side air bag module mounting studs must come through the deployment chute stud openings.



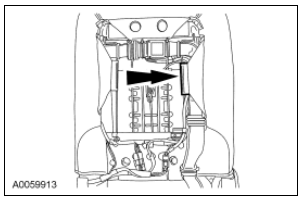
4. Position the seat side air bag to the bracket on the backrest frame and install the 2 nuts.
   - Tighten to 7 Nm (62 lb-in).
5. Install the seat side air bag module nut cover.
6. Reposition the backrest foam pad to the backrest frame as necessary.
7. Position the backrest trim cover and install the hog rings.



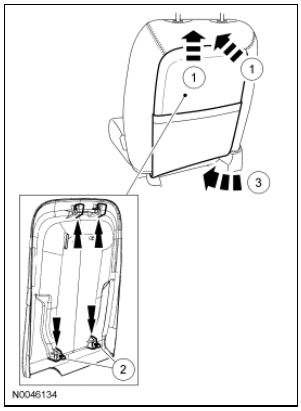
8. Attach all the backrest trim cover J-clips and the pin-type retainers.



9. If equipped, install the ventilation air—upper blower assembly and the pin-type retainer.
10. Attach the trim cover J-clip.



11. Install the seat backrest trim panel.
    1. Position the top of the backrest trim panel at an angle to the backrest frame and push it forward and slide it upward to engage the upper hooks.
    2. Continue positioning the backrest trim panel upward and align the 2 lower pin-type retainers with the holes in the backrest frame.
    3. Push the bottom of the backrest trim panel forward and seat the 2 pin-type retainers.



12. Install the head restraint.

13. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

Seat Cushion Cover — Front

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat cushion shown, passenger seat cushion similar.

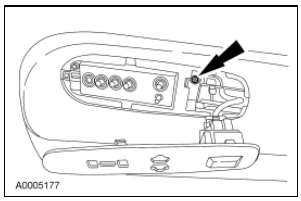
1. Remove the front seat and depower the SRS. For additional information, refer to Seat — Front in this section.

2. Carefully remove the seat control switch knobs.

3. Remove the front and rear side shield screws.

4. Detach and remove the seat control switch bezel.
   - If equipped, disconnect the power lumbar switch.

5. Remove the screw from behind the seat control switch bezel.



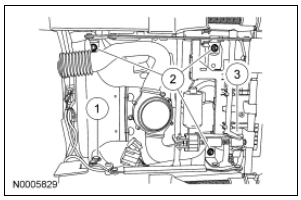
6. Disconnect the seat control switch electrical connector and remove the side shield.

7. Remove the manual lumbar knob.

8. Remove the 2 manual lumbar adjuster screws from the seat cushion pan.

9. If equipped, detach the ventilation air — upper blower assembly from the ventilation air — lower blower assembly.

10. Remove the nuts and the seat track.
    1. Detach the wire harness retainer from the seat track-to-cushion stud.
    2. Remove the 4 seat track-to-cushion nuts (3 shown).
        - ♦ To install, tighten to 20 Nm (15 lb-ft).
    3. Remove the seat cushion from the seat track and backrest assembly.
        - ♦ Disconnect and detach any electrical connectors as needed.



11. Detach the retainers and remove the cushion trim cover.
    - Separate the cushion trim cover from the cushion pan, cushion foam pad and, if equipped, the climate controlled seat cushion duct.

12. To install, reverse the removal procedure.

13. Install the front seat and repower the SRS. For additional information, refer to Seat — Front in this section.

Seat Backrest Thermo-Electric Device

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

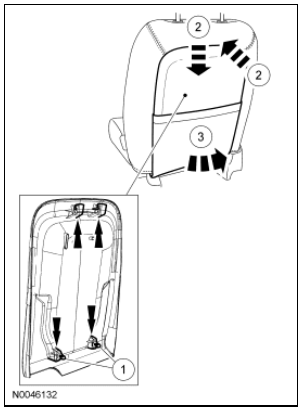
NOTE: Driver seat shown, passenger seat similar.

1. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

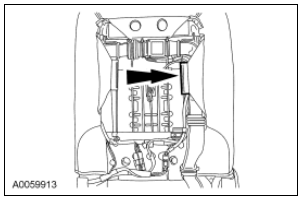
2. **⚠ CAUTION: The backrest trim panel must be inspected for cracked or broken upper hooks and lower retainer bosses. Remove and discard the lower pin-type retainers before inspecting the lower trim panel bosses. If any hook or boss is damaged a new backrest trim panel must be installed. Always install new pin-type retainers when installing a backrest trim panel.**

   Remove the seat backrest trim panel.

   1. Use an appropriate tool to release the 2 pin-type retainers at the lower bosses of the backrest trim panel.
   2. Push forward on the top of the backrest panel and slide it downward to release the upper hooks.
   3. Continue to push forward on the top of the backrest trim panel while rotating the bottom a few inches rearward to disengage the upper hook barbs.



3. Release the trim cover J-clip.



4. Remove the pin-type retainer, disconnect the electrical connector and remove the ventilation air — upper blower assembly.

5. To install, reverse the removal procedure.
   - For backrest trim panel installation:
     - Position the top of the backrest trim panel at an angle to the backrest frame and push it forward and slide it upward to engage the upper hooks.
     - Continue positioning the backrest trim panel upward and align the 2 lower pin-type retainers with the holes in the backrest frame.
     - Push the bottom of the backrest trim panel forward and seat the 2 pin-type retainers.

6. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

Seat Control Switch

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat cushion shown, passenger seat cushion similar.

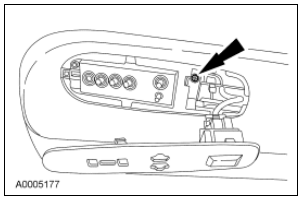
1. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

2. Carefully remove the seat control switch knobs.

3. Remove the front and rear side shield screws.

4. Detach and remove the seat control switch bezel.
   - If equipped, disconnect the power lumbar switch.

5. Remove the screw from behind the seat control switch bezel.



6. Disconnect the seat control switch electrical connector and remove the side shield.

7. Remove the 3 screws and the seat control switch.

8. To install, reverse the removal procedure.

9. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

Seat Cushion Thermo-Electric Device

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat cushion shown, passenger seat cushion similar.

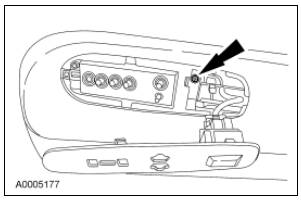
1. Remove the front seat and depower the SRS. For additional information, refer to Seat — Front in this section.

2. Carefully remove the seat control switch knobs.

3. Remove the front and rear side shield screws.

4. Detach and remove the seat control switch bezel.
   - If equipped, disconnect the power lumbar switch.

5. Remove the screw from behind the seat control switch bezel.



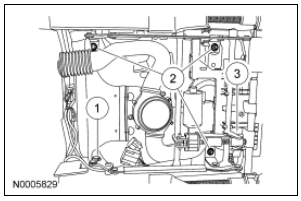
6. Disconnect the seat control switch electrical connector and remove the side shield.

7. Remove the manual lumbar knob.

8. Remove the 2 manual lumbar adjuster screws from the seat cushion pan.

9. Detach the ventilation air — upper blower assembly from the ventilation air — lower blower assembly.

10. Remove the seat track and the nuts.
    1. Detach the wire harness retainer from the seat track-to-cushion stud.
    2. Remove the 4 seat track-to-cushion nuts (3 shown).
        - ♦ To install, tighten to 20 Nm (15 lb-ft).
    3. Remove the seat cushion from the seat track and backrest assembly.
        - ♦ Disconnect and detach any electrical connectors as needed.



11. Remove the 5 screws and the ventilation air — lower blower assembly from the seat cushion pan.

12. To install, reverse the removal procedure.

13. Install the front seat and repower the SRS. For additional information, refer to Seat — Front in this section.

Seat Track

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

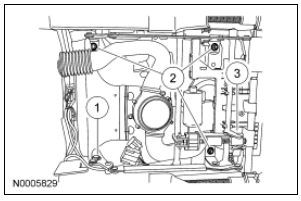
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat backrest shown, passenger seat backrest similar.

1. Remove the front seat and depower the SRS. For additional information, refer to Seat — Front in this section.

2. Remove the front seat backrest. For additional information, refer to Seat Backrest — Front in this section.

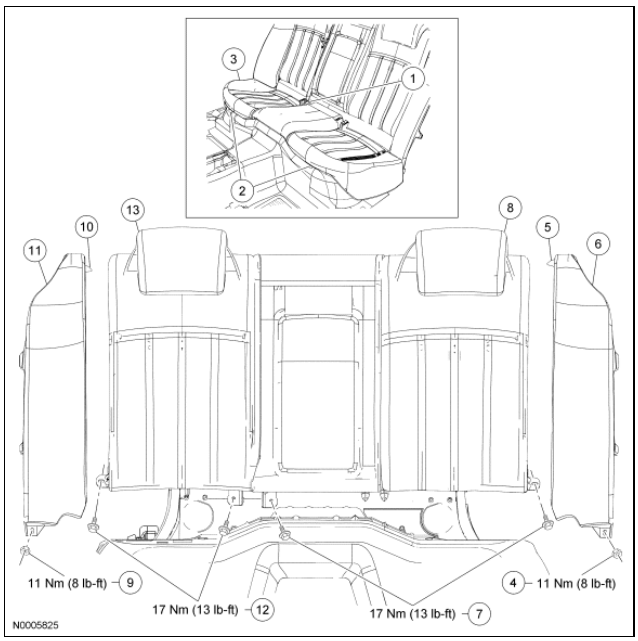
3. Remove the seat track.
    1. Detach the wire harness retainer from the seat track-to-cushion stud.
    2. Remove the 4 seat track-to-cushion nuts (3 shown).
        - ♦ To install, tighten to 20 Nm (15 lb-ft).
    3. Remove the seat track.
        - ♦ Disconnect and detach any electrical connectors as needed.



4. To install, reverse the removal procedure.

5. Install the front seat and repower the SRS. For additional information, refer to Seat — Front in this section.

Seat — Exploded View, Rear

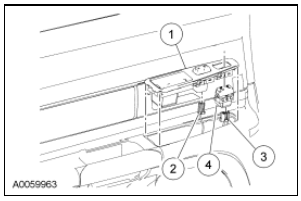


Item	Part Number	Description
1	600A38	Rear seat cushion mini-buckle
2	101C24	Cushion release levers
3	63804	Rear seat cushion
4	N620482-S	Left side bolster nut
5	101C24	Left side bolster release lever
6	66892	Left side bolster
7	W503942-S424	60 percent seat backrest fasteners
8	66601	60 percent seat backrest
9	N620482-S	Right side bolster nut
10	101C24	Right side bolster release lever
11	66892	Right side bolster
12	W503942-S424	40 percent seat backrest fasteners
13	66600	40 percent seat backrest

1. For additional information, refer to the procedures in this section.

Heated Seat Switch — Rear

NOTE: Left side shown, right side similar.



Item	Part Number	Description
1	14527	Bezel housing
2	14A005	Connector
3	14A005	Connector
4	14D695	Heated seat switch

Removal and Installation

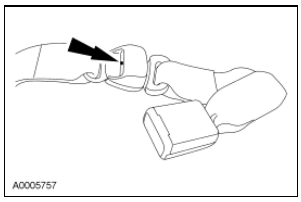
1. Detach the bezel housing from the door trim panel.
2. Disconnect the power window and heated seat switch electrical connectors.
3. Detach and remove the heated seat switch from the bezel housing.
4. To install, reverse the removal procedure.

Seat Backrest — Rear

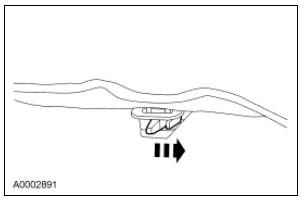
Removal

All backrests

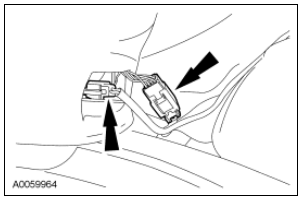
1. Using a suitable tool, release the mini-buckle.



2. Release the 2 levers located at the lower outboard edges of the seat cushion, lift the cushion up and pull the cushion out.



3. If equipped, disconnect the heated seat electrical connectors at both outboard sides of the seat cushion.



4. Remove the seat cushion.

5. Remove the LH rear seat bolster. Refer to Seat Bolster — Rear in this section.

60 percent backrest

6. From the luggage compartment, release the 60 percent seat backrest.

7. **NOTE:** Original fasteners must be discarded and new service fasteners installed. Service fasteners can be reused.

   Remove the two 60 percent rear seat backrest fasteners and discard.

8. Remove the 60 percent seat backrest.

40 percent backrest

9. Remove the RH rear seat bolster. Refer to Seat Bolster — Rear in this section.

10. From the luggage compartment, release the 40 percent seat backrest.

11. **NOTE:** Original fasteners must be discarded and new service fasteners installed. Service fasteners can be reused.

    Remove the two 40 percent rear seat backrest fasteners and discard.

12. Remove the 40 percent seat backrest.

Installation

40 percent backrest

1. Position the 40 percent seat backrest in the vehicle.

2. **NOTE:** Original fasteners must be discarded and new service fasteners installed. Service fasteners can be reused.

   Install 2 new 40 percent rear seat backrest bolt and washer assemblies W503942-S424.

   - Tighten to 17 Nm (13 lb-ft).

3. Install the RH rear seat bolster. Refer to Seat Bolster — Rear in this section.

60 percent backrest

4. Position the 60 percent seat backrest in the vehicle.

5. **NOTE:** Original fasteners must be discarded and new service fasteners installed. Service fasteners can be reused.

   Install 2 new 60 percent rear seat backrest bolt and washer assemblies W503942-S424.

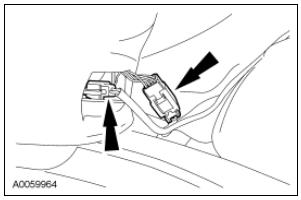
   - Tighten to 17 Nm (13 lb-ft).

6. Install the LH rear seat bolster. Refer to Seat Bolster — Rear in this section.

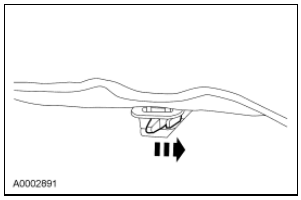
All backrests

7. Position the seat cushion in the vehicle.

8. If equipped, disconnect the heated seat electrical connectors at both outboard sides of the seat cushion.



9. Align the seat cushion and release the 2 levers located at the lower outboard edges of the seat cushion, press the cushion down and fully seat the seat cushion to the retainers.



10. Engage the mini-buckle.

11. Make sure the safety belts and buckles are accessible to the occupants after installation.

Seat Backrest Cover — Rear

Removal and Installation

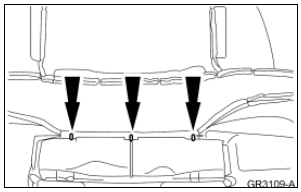
All backrests

1. Remove the rear seat backrest. For additional information, refer to Seat Backrest — Rear in this section.

60 percent backrest

2. Remove the backrest folding armrest.
3. ⚠ **CAUTION: Use care when separating the seat upholstery from the hook and loop strip, or the hook and loop strip can be torn from the seat backrest foam pad.**

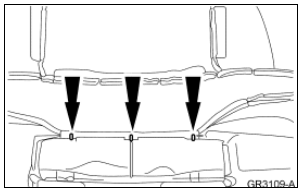
   Detach the 60 percent backrest J-strip and separate the backrest trim cover hook and loop fasteners.
4. Remove and discard the hog rings and remove the 60 percent backrest trim cover.



40 percent backrest

5. ⚠ **CAUTION: Use care when separating the seat upholstery from the hook and loop strip, or the hook and loop strip can be torn from the seat backrest foam pad.**

   Detach the 40 percent backrest J-strip and separate the backrest trim cover hook and loop fasteners.
6. Remove and discard the hog rings and remove the 40 percent backrest trim cover.



All backrests

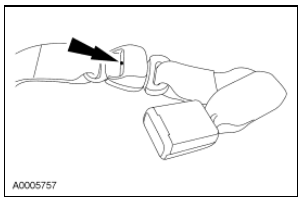
7. To install, reverse the removal procedure.

Seat Bolster — Rear

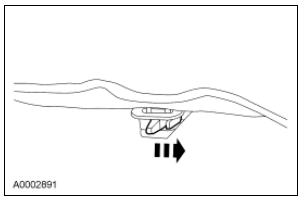
Removal and Installation

NOTE: LH side shown, RH side similar.

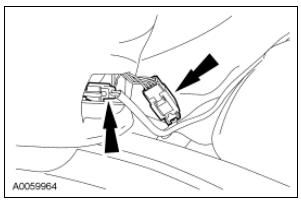
1. Using a suitable tool, release the mini-buckle.



2. Release the 2 levers located at the lower outboard edges of the seat cushion, lift the cushion up and pull the cushion out.



3. If equipped, disconnect the heated seat electrical connectors at both outboard sides of the seat cushion.

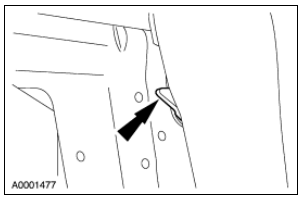


4. Remove the seat cushion.

5. Using the release lever located in the trunk, fold the appropriate seat backrest down.

6. Remove the nut at the bottom of the side bolster.
   - To install, tighten to 11 Nm (8 lb-ft).

7. Pull down the lever to release the LH latch and remove the LH side bolster.



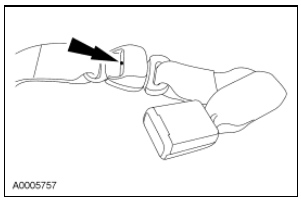
8. To install, reverse the removal procedure.

Seat Cushion — Rear

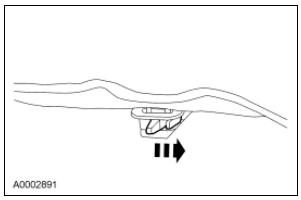
Removal and Installation

All seats

1. Using a suitable tool, release the mini-buckle.

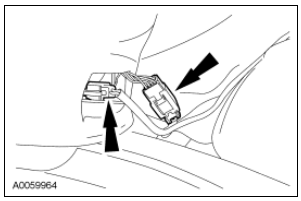


2. Release the 2 levers located at the lower outboard edges of the seat cushion, lift the cushion up and pull the cushion out.



Heated seats

3. Disconnect the heated seat electrical connectors at both outboard sides of the seat cushion.



All seats

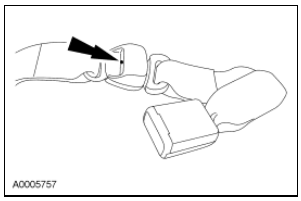
4. Remove the seat cushion.

5. To install, reverse the removal procedure.
   - Check the active restraint system for correct operation. For additional information, refer to Section 501-20A .

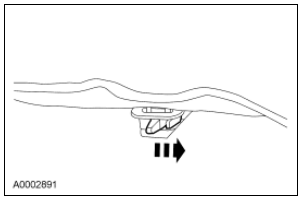
Seat Cushion Cover — Rear

Removal and Installation

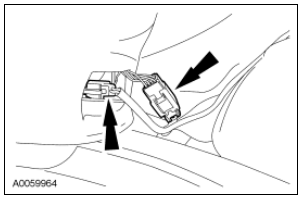
1. Using a suitable tool, release the mini-buckle.



2. Release the 2 levers located at the lower outboard edges of the seat cushion, lift the cushion up and pull the cushion out.



3. If equipped, disconnect the heated seat electrical connectors at both outboard sides of the seat cushion.



4. Remove the seat cushion.

5. Remove all the outer seat cushion trim cover hog rings.

6. ⚠ **CAUTION: Use care when separating the seat upholstery from the hook and loop strip, or the hook and loop strip can be torn from the seat cushion foam pad.**

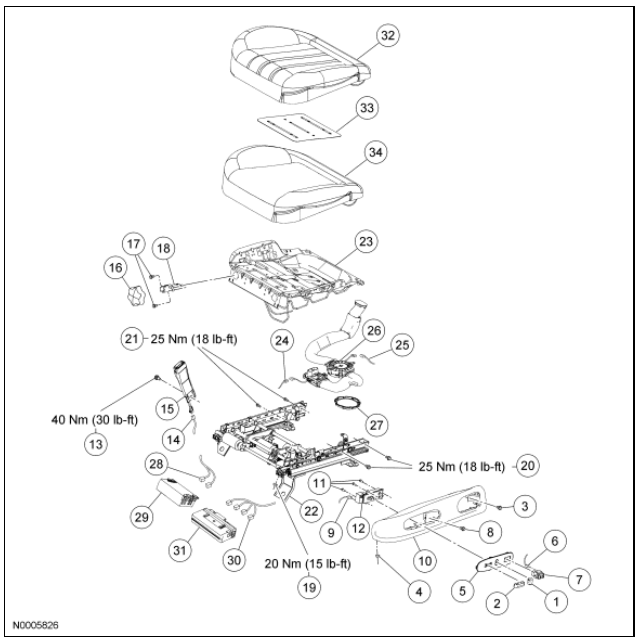
   Separate the hook and loop fasteners.

7. Remove all the inner seat cushion trim cover hog rings.

8. Remove the seat cushion trim cover.

9. To install, reverse the removal procedure.

Seat Cushion — Front



Item	Part Number	Description
1	14711	Seat control switch knob
2	14711	Seat control switch knob
3	56902-S	Side shield screw
4	56902-S	Side shield screw
5	14A706	Seat control switch bezel
6	14B719	Power lumbar switch electrical connector (if equipped)
7	14C723	Power lumbar switch (if equipped)
8	56902-S	Side shield screw
9	14B719	Seat control switch electrical connector
10	62185	Side shield
11	56902-S	Seat control switch screws
12	14A701	Power seat switch
13	18495	Safety belt buckle bolt
14	14B719	Connector
15	61203	Safety belt buckle
16	610A76	Manual lumbar knob (if equipped)
17	14C719	Manual lumbar adjuster screws (if equipped)
18	61203	Manual lumbar adjuster (if equipped)
19	N620482-S	Power seat track nut
20	009560	Backrest-to-seat track bolts
21	009560	Backrest-to-seat track bolts

22	61701	Power seat track
23	60327	Seat cushion pan
24	14C719 LH/ 14A699 RH	Cushion thermo-electric device electrical connector (if equipped)
25	14C719 LH/ 14A699 RH	Seat fan electrical connector (if equipped)
26	19N550	Blower assembly, ventilation air—lower
27	19E880	Blower assembly filter
28	14C719 LH/ 14A699 RH	Climate controlled seat module electrical connector (if equipped)
29	14C724	Climate controlled seat module (if equipped)
30	14C719 LH/ 14A699 RH	Driver seat module electrical connector (if equipped)
31	14C708	Driver seat module (if equipped)
32	62900	Cushion trim cover
33	19N550	Climate controlled seat cushion duct (if equipped)
34	632A22	Cushion foam pad

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

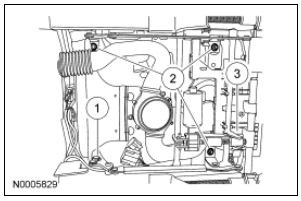
NOTE: Driver seat cushion shown, passenger seat cushion similar.

All seats

1. Remove the front seat and depower the SRS. For additional information, refer to Seat — Front in this section.

2. Remove the front seat backrest. For additional information, refer to Seat Backrest — Front in this section.

3. Remove the seat track and the nuts.
    1. Detach the wire harness retainer from the seat track-to-cushion stud.
    2. Remove the 4 seat track-to-cushion nuts (3 shown).
        - ♦ To install, tighten to 20 Nm (15 lb-ft).
    3. Remove the seat track.
        - ♦ Disconnect and detach any electrical connectors as needed.



Climate controlled seats

4. Disconnect and detach the electrical connectors and remove the ventilation air—lower blower assembly from the cushion pan.

5. Disconnect and remove the climate controlled seat module from the cushion pan.

All seats

6. If equipped, disconnect and remove the driver seat module from the cushion pan.

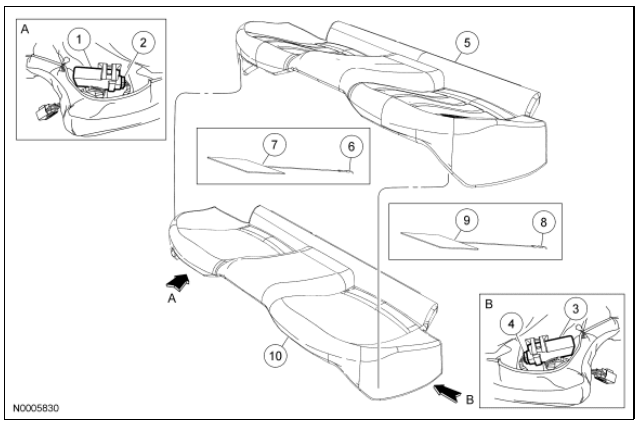
7. Detach the retainers and remove the cushion trim cover.
    - Separate the cushion trim cover from the cushion pan, cushion foam pad and, if equipped, the climate controlled seat cushion duct.

8. To assemble, reverse the disassembly procedure.

9. Install the front seat backrest. For additional information, refer to Seat Backrest — Front in this section.

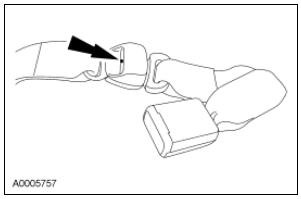
10. Install the front seat and repower the SRS. For additional information, refer to Seat — Front in this section.

Seat Cushion — Rear

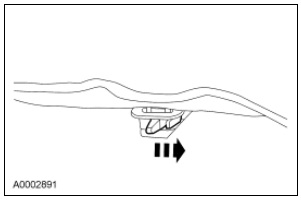


Item	Part Number	Description
1	14C724	Right heated seat module (if equipped)
2	19K315	Connector (if equipped)
3	14C724	Left heated seat module (if equipped)
4	19K315	Connector (if equipped)
5	63804	Cushion trim cover
6	19K315	Connector (if equipped)
7	14D698	Cushion heater element (if equipped)
8	19K315	Connector (if equipped)
9	14D698	Cushion heater element (if equipped)
10	600A88	Cushion foam pad

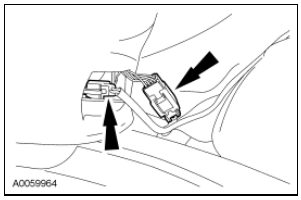
1. Using a suitable tool, release the mini-buckle.



2. Release the 2 levers located at the lower outboard edges of the seat cushion, lift the cushion up and pull the cushion out.



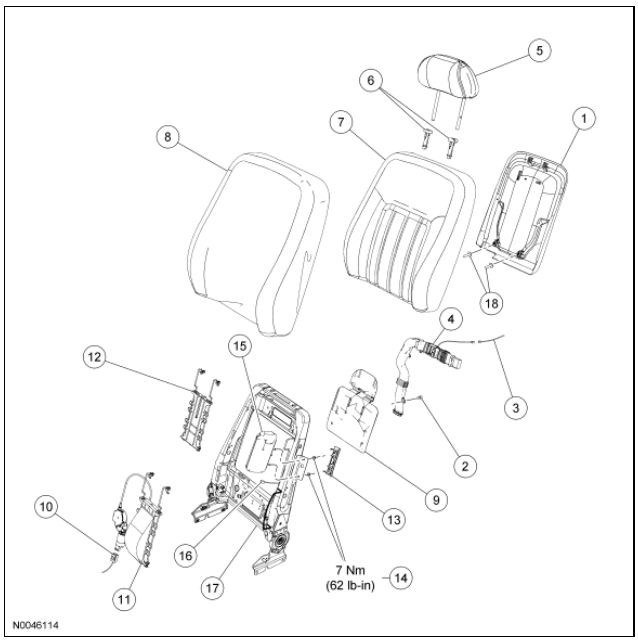
3. If equipped, disconnect the heated seat electrical connectors at both outboard sides of the seat cushion.



4. Remove the seat cushion.
5. If equipped, remove and disconnect the right heated seat module.
6. If equipped, remove and disconnect the left heated seat module.
7. Remove all the outer seat cushion trim cover hog rings.
8. **⚠ CAUTION: Use care when separating the seat upholstery from the hook and loop strip, or the hook and loop strip can be torn from the seat cushion foam pad.**

   Separate the hook and loop fasteners.
9. Remove all the inner seat cushion trim cover hog rings.
10. Remove the seat cushion trim cover.
11. If equipped, disconnect and remove the right cushion heater element as needed.
12. If equipped, disconnect and remove the left cushion heater element as needed.
13. To assemble, reverse the disassembly procedure.

Seat Backrest — Front



Item	Part Number	Description
1	60762	Backrest trim panel
2	807452	Pin-type retainer (if equipped)
3	14C719 LH/ 14A699 RH	Connector (if equipped)
4	19N550	Blower assembly, ventilation air—upper
5	611A09	Head restraint
6	610A16	Head restraint guide sleeves
7	64416	Backrest trim cover
8	64810	Backrest foam pad
9	19N550	Climate controlled seat backrest cushion duct (if equipped)
10	14C719 LH/ 14A699 RH	Connector (if equipped)
11	65500	Power lumbar assembly (if equipped)
12	65501	Manual lumbar assembly (if equipped)
13	009036	Seat side air bag nut cover
14	N620480-S	Seat side air bag nuts
15	11791	Seat side air bag module
15	611D10	Thorax side air bag module
16	14K155	Connector
17	61019	Backrest frame
18	W709782-S	Pin-type retainer (2 required)

Disassembly

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced (cleaning is permissible).

⚠ WARNING: Side air bag modules with damaged covers must be replaced.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

⚠ CAUTION: Do not handle or lift the seat by the inboard side shield or a torque tube (seat track motor cable and housing). Care must be taken when handling or lifting the seat to prevent damage.

NOTE: If a side air bag deployment took place, the backrest foam pad, trim cover and side air bag module must be replaced. The backrest frame should be replaced if necessary.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

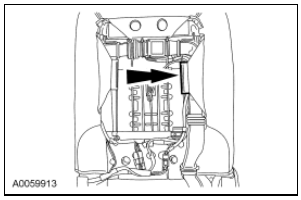
NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The driver seat is shown, the passenger seat is similar.

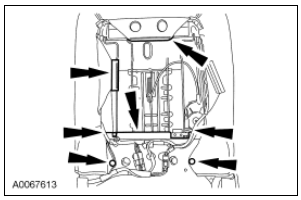
NOTE: A seat side air bag module is shown, a seat side thorax air bag module is similar. For additional information, refer to Section 501-20B in the Description and Operation portion of the section.

1. Remove the front seat and depower the SRS. For additional information, refer to Seat — Front in this section.
2. Remove the front seat backrest. For additional information, refer to Seat Backrest — Front in this section.
3. Remove the head restraint.
4. Release the trim cover J-clip.

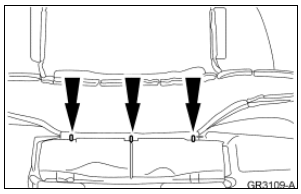


5. If equipped, remove the pin-type retainer and the ventilation air—upper blower assembly.

6. Detach all the backrest trim cover J-clips and the pin-type retainers.



7. Partially remove the backrest trim cover to access the hog rings and remove and discard the hog rings.

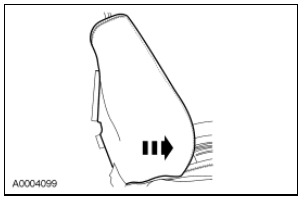


8. Remove the seat side air bag module nut cover.

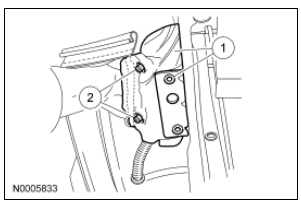
9. **NOTE:** If installing a new side air bag module, use new retaining nuts. If the same side air bag module is to be reused then reuse the side air bag module nuts.

   Remove the 2 seat side air bag module nuts from the backrest frame.

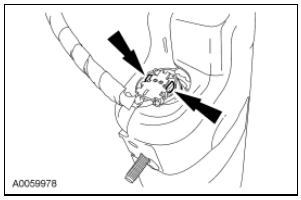
10. With one hand on the seat side air bag module, position the backrest trim cover and foam pad forward enough to access the seat side air bag module.



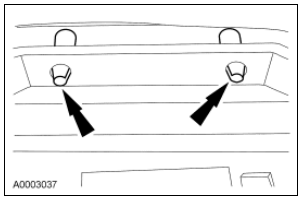
11. Remove the seat side air bag module from the deployment chute.
    1. Separate the seat side air bag module and deployment chute from the backrest frame mounting bracket.
    2. Pull the seat side air bag module mounting studs back through the deployment chute openings and remove the seat side air bag module from the deployment chute.



12. Squeeze the tabs together, disconnect and remove the seat side air bag module.



13. Pinch the end of the head restraint guide sleeves and remove.



14. Remove the backrest trim cover.
    - Carefully route the seat side air bag module deployment chute through the opening in the backrest foam pad.

15. Remove the backrest foam pad from the backrest frame.
    - If equipped, remove the climate controlled seat duct from the backrest foam pad as needed.

16. Detach and remove the lumbar assembly.

Assembly

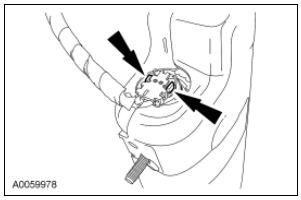
1. Install and attach the lumbar assembly.

2. Install the backrest foam pad to the backrest frame.
    - If equipped, install the climate controlled seat duct to the backrest foam pad.

3. Position the backrest trim cover to the backrest frame and install the head restraint guide sleeves.
    - Position the seat side air bag module deployment chute through the opening in the backrest foam pad.

4. ⚠ **CAUTION: Make sure the correct seat mounted air bag module is being used. The seat side air bag module and the seat side thorax air bag module electrical connectors are unique and will not interchange. Match the electrical connector key to the keyway in the air bag module. Do not alter or force the electrical connector into the seat mounted air bag module. For additional information, refer to Section 501-20B in the Description and Operation portion of the section.**

   Match the electrical connector key to the keyway and connect the seat side air bag module or seat side thorax air bag module.



5. ⚠ **WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.**

⚠ WARNING: Inspect the side air bag deployment chute and the side air bag cavity in the seat back pad for any foreign objects. If any foreign objects are found remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

⚠ WARNING: Before installing the side air bag module into the deployment chute, check it for damage and foreign objects. If the air bag module is damaged, replace it. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

⚠ WARNING: If the air bag cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment.

⚠ WARNING: Check the side air bag deployment chute for damage. The deployment chute must not be repaired. If there is any damage to the deployment chute, the seat back trim cover and deployment chute must be installed new as a unit.

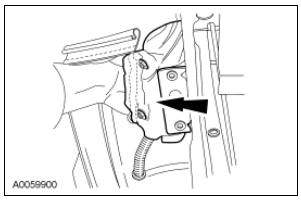
⚠ WARNING: If the air bag deployment chute is not properly positioned, the side air bag may not deploy properly.

⚠ WARNING: Inspect the mounting surfaces of the deployment chute and the seat back frame mounting bracket for any foreign objects, before installing the side air bag module/deployment chute assembly. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

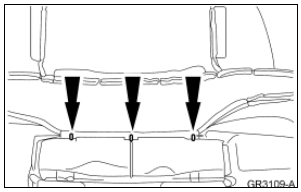
NOTE: The alignment pin will only allow the seat side air bag module to be installed to the seat back mounting bracket one way.

Position the seat side air bag module into the deployment chute.

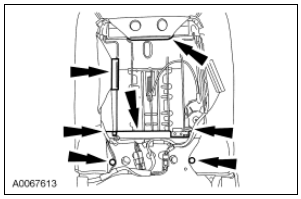
- Position the seat side air bag module into the deployment chute with the alignment pin offset to the top and the electrical connector to the bottom of the backrest. This will position the alignment pin correctly when the seat side air bag module and deployment chute are mounted to the backrest frame mounting bracket.
- The seat side air bag module mounting studs must come through the deployment chute stud openings.



6. Position the seat side air bag to the bracket on the backrest frame and install the 2 nuts.
   - Tighten to 7 Nm (62 lb-in).
7. Install the seat side air bag module nut cover.
8. Reposition the backrest foam pad to the backrest frame as necessary.
9. Position the backrest trim cover and install the hog rings.

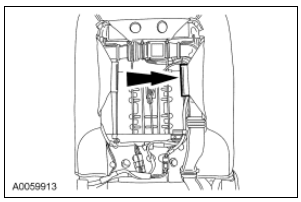


10. Attach all the backrest trim cover J-clips and the pin-type retainers.



11. If equipped, install the ventilation air — upper blower assembly and the pin-type retainer.

12. Attach the trim cover J-clip.

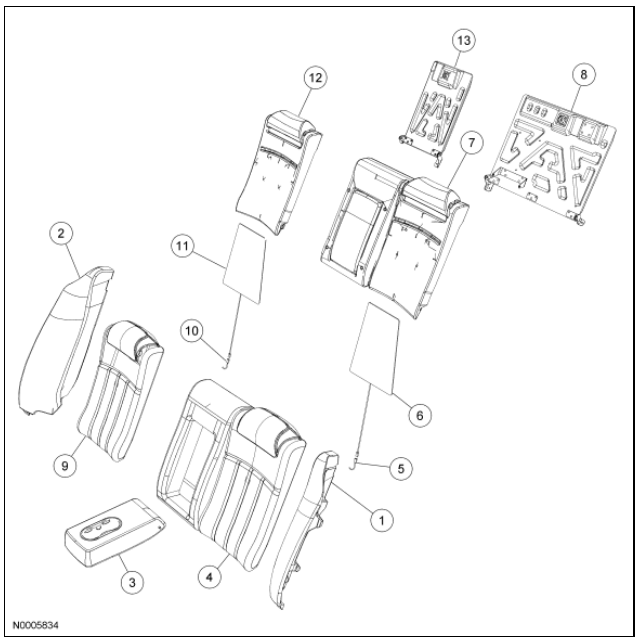


13. Install the head restraint.

14. Install the front seat backrest. For additional information, refer to Seat Backrest — Front in this section.

15. Install the front seat and repower the SRS. For additional information, refer to Seat — Front in this section.

Seat Backrest — Rear



Item	Part Number	Description
1	66893	Left bolster
2	66892	Right bolster
3	67244	Backrest folding armrest
4	66601	60 percent seat backrest trim cover
5	19K315	Backrest heater element electrical connector (if equipped)
6	14D698	Backrest heater element (if equipped)
7	66800	60 percent seat backrest foam pad
8	613A38	60 percent seat backrest support panel
9	66600	40 percent seat backrest trim cover
10	19K315	Backrest heater element electrical connector (if equipped)
11	14D698	Backrest heater element (if equipped)
12	66800	40 percent seat backrest foam pad
13	613A38	40 percent seat backrest support panel

Disassembly and Assembly

All backrests

1. Remove the rear seat backrest. For additional information, refer to Seat Backrest — Rear in this section.

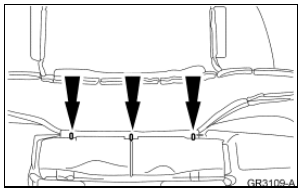
60 percent backrest

2. Remove the backrest folding armrest.

3. **⚠ CAUTION: Use care when separating the seat upholstery from the hook and loop strip, or the hook and loop strip can be torn from the seat backrest foam pad.**

   Detach the 60 percent backrest J-strip and separate the backrest trim cover hook and loop fasteners.

4. Remove and discard the hog rings and remove the 60 percent backrest trim cover.



5. If equipped, remove the backrest heater element as needed from the 60 percent backrest foam pad.

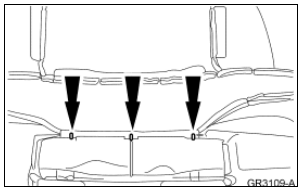
6. Remove the 60 percent backrest support panel.

40 percent backrest

7. **⚠ CAUTION: Use care when separating the seat upholstery from the hook and loop strip, or the hook and loop strip can be torn from the seat backrest foam pad.**

   Detach the 40 percent backrest J-strip and separate the backrest trim cover hook and loop fasteners.

8. Remove and discard the hog rings and remove the 40 percent backrest trim cover.



9. If equipped, remove the backrest heater element as needed from the 40 percent backrest foam pad.

10. Remove the 40 percent backrest support panel.

All backrests

11. To assemble, reverse the disassembly procedure.

General Specifications

Item	Specification
Laquer Touch-Up Paint (match color to exterior grid wire)	ESR-M2P100-C
Foam Core Butyl	WSB-M3G143-B1
Polypropylene Film Fine Line Tape (commercially available)	—
Rear Window Defroster Repair PM-11 (Canada CPM-11)	—
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A
DOW AUTOMOTIVE 2-HOUR CURE	
Urethane Adhesive Betaseal® Express	—
Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	—
SIKA 2-HOUR CURE	
Urethane Adhesive Sika Tack ASAP	—
Urethane Metal and Glass Primer Sika 206 G+P	—

Torque Specifications

Description	Nm	lb-ft	lb-in
Door latch screws	12	9	—
Front and rear door inner module assembly bolts	12	9	—
Front door inner support bracket bolt	12	9	—
Front door inner support bracket nuts	12	9	—
Front door lower theft shield screw	10	—	89
Front door window glass regulator nuts	5	—	44
Front door window regulator-to-glass clamp bolts	12	9	—
Rear door window regulator nuts	10	—	89
Rear door window regulator motor screws	3	—	27

Glass, Frames and Mechanisms

The glass, frames and mechanisms consist of the following:

- front door window glass
- front door window motors
- front door window regulators
- rear door window motors
- rear door window glass
- rear door window regulators
- rear quarter window glass
- rear window glass
- window control switches
- windshield glass

Glass, Frames and Mechanisms

Refer to Wiring Diagrams Cell 56 for schematic and connector information.

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles Of Operation

One-Touch Down/Up Window

The one-touch down feature can be activated by pressing either front window control switch to the second down position. This allows either front door window glass to move downward until it is fully lowered. Momentarily pressing the front window control switch while the window is moving downward stops the front door window glass and restores proportional down operation. The one-touch up feature can be activated and operated in the same manner by pressing the window control switch to the second up position.

Door Window Glass

The bottom of the door window glass is mounted on a slider bracket which is part of the door window regulator. Door window glass bracket spacers provide attachment points for the door window glass and prevent direct contact between the slider bracket and the door window glass.

Window Control Switch

The driver window control switch can be used to power any or all of the windows. A single window control switch is located on all passenger door armrests to activate that individual window only. The driver window control switch sends a voltage signal directly to the smart motors for operation of the front window motors in the commanded direction. The driver window control switch sends a voltage signal to the driver door module (DDM). When rear window motor operation is requested, the DDM sends a message over the standard corporate protocol (SCP) network to the rear electronic module (REM). The REM operates the rear window motors in the commanded direction.

Window Motor

NOTE: The front window motors require initialization. Refer to Door Window Motor Initialization in this section.

New front and rear window motors are installed separately. The front window motors are "smart" window motors, meaning they have the one-touch up/down features. The rear window motors have no one-touch up or down operation, only proportional up/down operation.

Front Electronic Module (FEM) and Rear Electronic Module (REM)

The FEM receives inputs and delivers outputs to a majority of the electronically controlled features which reside primarily in the front of the vehicle, including the RH power window. The REM receives inputs and delivers outputs to a majority of the electronically controlled features which reside primarily in the rear of the vehicle, including the rear power windows. The FEM and REM are configurable modules and must be correctly configured to the vehicle. The modules may also be configured to allow additional features or functions to be added to the vehicle. The FEM and REM do not have any optional window control configurations.

Driver Door Module (DDM)

The DDM receives inputs from the remote keyless entry (RKE) transmitter and hardwired components such as the LH front window control switch and delivers outputs in the form of SCP network messages and hardwired component control, including control of the LF and RF power window and roof opening panel (if equipped) during the global open/close feature. The DDM is a configurable module and must be correctly configured to the vehicle. The DDM may also be configured to allow additional features or functions to be added to the vehicle. The only DDM window feature that can be optionally configured is the window global open and close feature.

Global Open/Close

The global open/close feature is controlled by the DDM. The global open feature involves the DDM either receiving a signal from the door lock cylinder being held in the UNLOCK position for 2 seconds or the DDM receiving a signal from an RKE transmitter (when the customer holds the UNLOCK button on the transmitter for 2 seconds to activate the feature) and sending a voltage signal to the LH front, RH front smart window motors and the smart roof opening panel motor (if equipped). The smart window motors and smart roof opening panel motor carry out a global open (simultaneous opening of the front windows and roof opening panel). Pressing any button on the RKE transmitter, or actuating the door lock cylinder to the UNLOCK or LOCK position interrupts the global open function.

The global close feature can only be accomplished with the key in the door lock cylinder. The key must hold the door lock cylinder to the LOCK position for 2 seconds, at which time the DDM receives the door lock cylinder signal and sends a global close signal to the smart window motor and the smart roof opening panel motors. The smart motors then carry out a global close (simultaneous closing of the front windows and roof opening panel) function. The global close function can be terminated in the same manner as the global open function.

Module Inputs and Outputs

This system is unique in that many of the inputs that the FEM, REM and DDM receive are over the SCP communication network. These input messages come from other modules connected to the network. The FEM, REM and DDM interpret the inputs then command the correct output that was requested. The modules also receive inputs which come from components directly hardwired to the modules, such as the window control switches.

One type of output the modules provide is over the SCP communication network in the form of messages.

These types of outputs are usually generated from a module monitoring a hardwired input and sending a status message to another module. These outputs are commonly required by other modules to carry out their functions. The second type of output is the control of a component directly hardwired to the module.

Passenger Window Power Supply

The REM controls the power supply to all 3 passenger window control switches. To protect the REM from a potential failure, the REM removes voltage from the common passenger window power supply when a short to ground is sensed in any passenger window control switch, associated circuitry or the power output circuit of the REM. Power is restored to the power output circuit upon a cycling of the ignition switch. If the REM output circuit is shorted to ground, the REM immediately removes voltage from the common power supply circuit. If any passenger window control switches or their associated circuits are shorted to ground, the power remains on the REM output circuit until the switch or circuit containing the short to ground is activated.

Passenger Window Lock-Out

The LH front window control switch incorporates a passenger window lock-out switch. Activating the passenger window lock-out switch sends a separate voltage signal to the DDM. The DDM then outputs a message to the REM. The REM removes voltage to the passenger window control switches. Passenger window operation is allowed from only the LH front window control switch, or until the passenger window lock-out switch is turned off.

Passenger Front Power Window

The passenger front power window is controlled by input signals from the LH front window control switch or the RH front window control switch. The REM powers the RH front window control switch, which sends a voltage signal (when activated by the passenger) to the RH front window smart motor. The window motor raises or lowers (proportionally or one-touch, depending on the command) the window according to the command signal from the RH front window control switch. The DDM powers the LH front window control switch so it may send a voltage signal (when activated by the driver) to the RH front window smart motor.

LH Rear and RH Rear Power Windows

The LH rear and RH rear power windows are controlled by the REM. Operating commands for the rear power windows are received from the LH front window control switch over the SCP network from the DDM, or directly from the LH rear or RH rear window control switches, which are hardwired to the REM.

Activating the LH rear or RH rear switch on the LH front window control switch causes the DDM to send a message to the REM over the SCP network. The REM then controls voltage and ground to the appropriate window motor to raise or lower the window.

Activating either the LH rear or RH rear window control switch sends a voltage signal to the REM. The REM controls voltage and ground to the appropriate window motor to raise or lower the window. A voltage signal is only received if the window lockout is OFF and the REM is supplying voltage to the rear window control switch voltage circuit. The rear window motors are not smart motors and have only proportional mode operation with no one-touch operation.

Heated Rear Window

The heated rear window is controlled by the REM, powertrain control module (PCM) and the dual automatic temperature control (DATC) module. The heated rear window switch is incorporated into the DATC module. When the switch is pressed ON, the DATC module sends a message over the SCP network to the REM. The REM checks other messages for vehicle rpm from the PCM. If the rpm message is received, the REM grounds the heated rear window relay coil control circuit (which is hardwired to the REM). The ground signal closes

the heated rear window relay which applies voltage to the heated rear window grid. Fault management of the heated rear window feature prevents the heated rear window from operating when an rpm or ignition switch invalid/missing data message is received. The heated rear window eliminates condensation on the rear window.

Diagnosis

The FEM, REM and DDM constantly monitor their systems and generate diagnostic trouble codes (DTC) if there is a concern. DTCs can be retrieved with the diagnostic tool or an equivalent tester through the SCP communication network.

This vehicle design makes it unique in that electronic functions are divided into zones. The DDM controls features near the driver front door. The FEM controls features in the front portion of the vehicle and the REM controls the features in the rear portion. These systems use the SCP communication network in order to transmit and receive messages. It is vital when diagnosing the vehicle electronic systems to understand where the input (command) originates, all input information messages necessary in order for a feature to operate correctly, which module(s) receive(s) the input (or command message), if the module which received the input (message) controls the output of the feature or does it output a message over the communication network to another module, and which module controls the output of the feature.

Delayed Accessory

The delayed accessory feature allows the power windows, radio and roof opening panel (if equipped) to function for up to 10 minutes after the ignition is turned OFF or until any door is opened. The delayed accessory function is controlled by the DDM. When the ignition switch is turned from ON to OFF, the DDM begins the timing sequence. If a door is opened, the FEM or the REM (the FEM monitors the front door ajar switches and the REM monitors the rear door ajar switches) sends a signal to the DDM over the SCP network, and the DDM turns off the accessory delay function. If the ignition switch is turned to another position, the DDM also cancels the delayed accessory function.

Heated Wiper Park

The heated wiper park grid (located within the lower painted area of the windshield) receives voltage from the heated wiper park relay located in the underhood auxiliary junction box (AJB). The heated wiper park relay coil is connected to a fused circuit from the underhood AJB. The heated wiper park relay is controlled by a switched ground from the dual automatic temperature control (DATC) module heated wiper park ON/OFF switch. The heated wiper park grid is automatically activated by the DATC module when ambient air temperature drops below 3° C (38° F) and shuts off automatically when ambient air temperature rises above 3° C (38° F), or if the vehicle voltage is low.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Window regulator • Window run weather-strip • Door window glass	• Battery junction box (BJB) fuse: ♦ 19 (20A) ♦ 20 (30A) ♦ 29 (40A) ♦ 30 (20A) • Underhood auxiliary junction box (AJB) fuse 13 (30A) • LH front window control switch • RH front, LH rear or RH rear window control switch(es) • Window motor(s) • DATC module • DDM • FEM • REM • Heated rear window grid • Heated wiper park grid • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP, UBP or ISO circuit fault, all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for the DDM, DATC, FEM or REM; refer to Section 419-10 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the DDM, DATC, FEM or REM.

7. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index, the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index or the Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	FEM	CLEAR the DTC. REPEAT the FEM self-test. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 .

			REPEAT the self-test.
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
All Other DTCs	—	FEM	REFER to Section 419-10 .

Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	REM	CLEAR the DTC. REPEAT the REM self-test. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 . REPEAT the self-test.
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	GO to Pinpoint Test D .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	GO to Pinpoint Test D .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	GO to Pinpoint Test D .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	GO to Pinpoint Test D .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
All Other DTCs	—	REM	REFER to Section 419-10 .

Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	DDM	CLEAR the DTC. REPEAT the self-test. If DTC B1342 is retrieved, INSTALL a new DDM. REFER to Section 419-10 . REPEAT the self-test.
B1416	Power Window LR Motor Circuit Short to Battery	DDM	GO to Pinpoint Test D .
B1424	Power Window RR Motor Circuit Short to Battery	DDM	GO to Pinpoint Test D .
B2359	Accessory Delay Output Circuit Failure	DDM	CHECK circuit 10-AJ43 (GY/VT) for an open, a short to ground, or a short to voltage. If no fault is found, INSTALL a

			new DDM. REFER to Section 419-10 . TEST the system for normal operation.
B2360	Window Motor Control Output Circuit Failure	DDM	GO to Pinpoint Test F .
B2477	Module Configuration Failure	DDM	REFER to Section 418-01 .
All Other DTCs	—	DDM	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: All Power Windows Are Inoperative

Normal Operation

The LH front smart window motor receives voltage from the battery junction box (BJB) through circuit 30-AJ80 (RD) while the RH front smart window motor receives voltage from the BJB through circuit 30-AJ71 (RD/YE). The driver door module (DDM) provides a delayed accessory voltage to both smart motors through circuit 10-AJ43 (GY/VT). This is only used by the smart motors as input logic. The LH front window control switch receives voltage from the DDM on circuit 7-AJ7 (YE/RD) and ground on circuit 31-AJ7 (BK/BU). When either of the smart motors receives an input from their respective window control switches, they operate in the commanded direction. Voltage from the BJB at all times is necessary for the global open/close feature to operate. The rear window motors are not smart motors, so they receive voltage from the rear electronic module (REM), as per the command from their respective window control switches to the REM. If the command originates from the LH front window control switch, the DDM sends a message over the SCP bus to the REM, which commands the correct window motor in the desired direction.

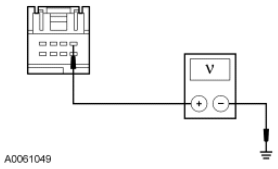
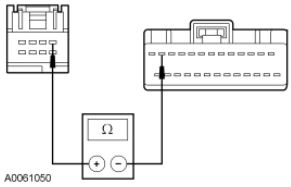
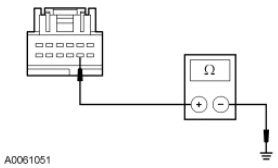
Possible Causes

- circuit 7-AJ7 (YE/RD) open
- circuit 31-AJ7 (BK/BU) open
- LH front window control switch
- DDM

PINPOINT TEST A: ALL POWER WINDOWS ARE INOPERATIVE

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
A1 CHECK CIRCUIT 7-AJ7 (YE/RD) FOR VOLTAGE	

• Ignition OFF. • Disconnect: LH Front Window Control Switch C504b. • Ignition ON. • Measure the voltage between the LH front window control switch C504b-1, circuit 7-AJ7 (YE/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A3 . **No** GO to A2 .
A2 CHECK CIRCUIT 7-AJ7 (YE/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: DDM C501d. • Measure the resistance between the LH front window control switch C504b-1, circuit 7-AJ7 (YE/RD), harness side and the DDM C501d-12, circuit 7-AJ7 (YE/RD), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
A3 CHECK CIRCUIT 31-AJ7 (BK/BU) FOR AN OPEN	
• Ignition OFF. • Disconnect: LH Front Window Control Switch C504a. • Measure the resistance between the LH front window control switch C504a-8, circuit 31-AJ7 (BK/BU), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK FOR CORRECT DDM OPERATION	
• Disconnect all the DDM connectors. • Check for:	**Yes** INSTALL a new DDM. REFER to Section 419-10 . TEST the system

• corrosion • pushed-out pins • Connect all the DDM connectors and make sure they seat correctly. • Operate the system and verify if the concern is still present. • **Is the concern still present?**	for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: A Single Power Window Is Inoperative — LH Front

Normal Operation

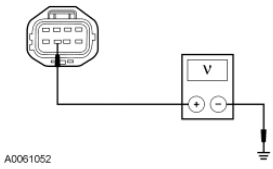
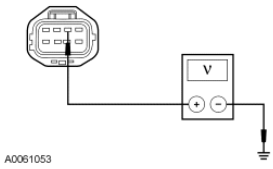
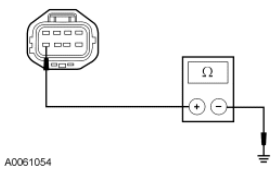
The LH front window smart motor receives voltage from the battery junction box (BJB) on circuit 30-AJ80 (RD) and ground from circuit 31-AJ80 (BK/OG). A delayed accessory input is sent from the driver door module (DDM) to the LH front window smart motor on circuit 10-AJ43 (GY/VT) so the LH front window smart motor microprocessor can determine whether or not to allow window motor operation. The LH front window control switch sends a command over circuits 7S-AJ41 (YE/BK), 8-AJ42 (WH/GN) or 7S-AJ40 (YE/GN) to the LH front smart window motor to initiate operation.

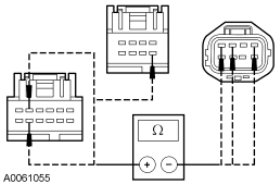
Possible Causes

- fuse
- circuit 7S-AJ40 (YE/GN) open or short to ground
- circuit 7S-AJ41 (YE/BK) open or short to ground
- circuit 8-AJ42 (WH/GN) open or short to ground
- circuit 10-AJ43 (GY/VT) open or short to ground
- circuit 30-AJ80 (RD) open
- circuit 31-AJ80 (BK/OG) open
- BJB
- LH front window control switch
- LH front window motor
- DDM

PINPOINT TEST B: A SINGLE POWER WINDOW IS INOPERATIVE — LH FRONT

Test Step	Result / Action to Take
B1 CHECK THE VOLTAGE TO THE WINDOW MOTOR	
NOTE: The LH front window motor is not on the multiplex link. **NOTE:** A new LH front window motor is in the proportional up/down mode until initialized. Refer to Door Window Motor Initialization in this section. **NOTE:** The LH front window motor must be initialized whenever the following occurs: the motor is removed from the window regulator, a new window motor is installed, a new window regulator is installed, a new window glass is installed, a new top run is installed and any operation in which grease or lubricants are applied to the window system.	**Yes** GO to B2 . **No** VERIFY the BJB fuse 20 (30A) is OK. If OK, REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.

• Ignition OFF. • Disconnect: LH Front Window Motor C524. • Measure the voltage between the LH front window motor C524-7, circuit 30-AJ80 (RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	
B2 CHECK THE LH FRONT WINDOW MOTOR DELAYED ACCESSORY VOLTAGE	
• Ignition ON. • Measure the voltage between the LH front window motor C524-2, circuit 10-AJ43 (GY/VT), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to B3 . **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.
B3 CHECK THE LH FRONT WINDOW MOTOR GROUND	
• Ignition OFF. • Measure the resistance between the LH front window motor C524-8, circuit 31-AJ80 (BK/OG), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to B4 . **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.
B4 CHECK CIRCUITS 7S-AJ40 (YE/GN), 7S-AJ41 (YE/BK) AND 8-AJ42 (WH/GN) FOR AN OPEN	
• Disconnect: LH Front Window Control Switch C504a, C504b. • Measure the resistance between the LH front window control switch C504a-5, circuit 7S-AJ40 (YE/GN),	**Yes** GO to B5 . **No** REPAIR the circuit(s) as necessary.

harness side and the LH front window motor C524-4, circuit 7S-AJ40 (YE/GN), harness side; and between LH front window control switch C504a-11, circuit 8-AJ42 (WH/GN), harness side and the LH front window motor C524-1, circuit 8-AJ42 (WH/GN), harness side; and between the LH front window control switch C504b-5, circuit 7S-AJ41 (YE/BK), harness side and the LH front window motor C524-3, circuit 7S-AJ41 (YE/BK), harness side.  • **Are the resistances less than 5 ohms?**	DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.
B5 CHECK THE LH FRONT WINDOW CONTROL SWITCH FOR CORRECT OPERATION	
• Carry out the window control switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the LH front window control switch pass the component test?**	**Yes** INSTALL a new LH front window motor. REFER to Front Door Window Regulator and Motor in this section. INITIALIZE the LH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation. **No** INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation.

Pinpoint Test C: A Single Power Window Is Inoperative — RH Front

Normal Operation

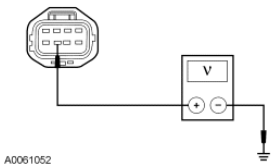
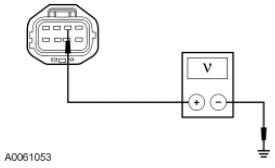
The RH front window smart motor receives voltage from the battery junction box (BJB) on circuit 30-AJ71 (RD/YE) and ground from circuit 31-AJ71 (BK/YE). A delayed accessory input is sent from the driver door module (DDM) to the RH front smart motor on circuit 10-AJ43 (GY/VT) so the RH front smart window motor microprocessor can determine whether or not to allow window motor operation. The RH front window control switch sends a command over circuits 7S-AJ47 (YE/BK), 8-AJ56 (WH/GN) or 7S-AJ48 (YE/VT) to the RH front smart window motor to initiate operation.

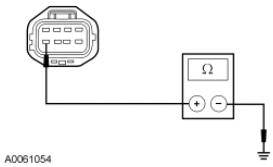
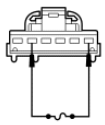
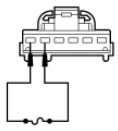
Possible Causes

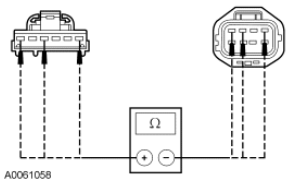
- fuse
- circuit 7S-AJ47 (YE/BK) open or short to ground
- circuit 7S-AJ48 (YE/VT) open or short to ground
- circuit 8-AJ56 (WH/GN) open or short to ground
- circuit 30-AJ71 (RD/YE) open

- circuit 31-AJ71 (BK/YE) open
- BJB
- RH front window control switch
- RH front window motor

PINPOINT TEST C: A SINGLE POWER WINDOW IS INOPERATIVE — RH FRONT

Test Step	Result / Action to Take
C1 CHECK THE VOLTAGE TO THE WINDOW MOTOR	
NOTE: The RH front window motor is not on the multiplex link. **NOTE:** A new RH front window motor is in the proportional up/down mode until initialized. Refer to Door Window Motor Initialization in this section. **NOTE:** The RH front window motor must be initialized whenever the following occurs: the motor is removed from the window regulator, a new window motor is installed, a new window regulator is installed, a new window glass is installed, a new top run is installed and any operation in which grease or lubricants are applied to the window system. • Ignition OFF. • Disconnect: RH Front Window Motor C608. • Measure the voltage between the RH front window motor C608-7, circuit 30-AJ71 (RD/YE), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to C2 . **No** VERIFY the BJB fuse 20 (30A) is OK. If OK, REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.
C2 CHECK THE RH FRONT WINDOW MOTOR DELAYED ACCESSORY VOLTAGE	
• Ignition ON. • Measure the voltage between the RH front window motor C608-2, circuit 10-AJ43 (GY/VT), harness side and ground.  	**Yes** GO to C3 . **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.

• **Is the voltage greater than 10 volts?**	
C3 CHECK THE RH FRONT WINDOW MOTOR GROUND	
• Ignition OFF. • Measure the resistance between the RH front window motor C608-8, circuit 31-AJ71 (BK/YE), harness side and ground.  A0061054 • **Is the resistance less than 5 ohms?**	**Yes** GO to C4 . **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.
C4 CHECK THE RH FRONT WINDOW MOTOR	
• Disconnect: RH Front Window Control Switch C604. • Ignition ON. • Connect a fused (5A) jumper wire between the RH front window control switch C604-1, circuit 7S-AJ47 (YE/BK), harness side and the RH front window control switch C604-5, circuit 7-AJ18 (YE/VT), harness side. The window should operate in the up direction.  A0068542 • Connect a fused (5A) jumper wire between the RH front window control switch C604-6, circuit 7S-AJ48 (YE/VT), harness side and the RH front window control switch C604-5, circuit 7-AJ18 (YE/VT), harness side. The window should operate in the down direction.  A0068543 • **Does the window operate correctly?**	**Yes** INSTALL a new RH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** REMOVE the fused jumper wire. GO to C5 .
C5 CHECK CIRCUITS 7S-AJ47 (YE/BK), 7S-AJ48 (YE/VT) AND 8-AJ56 (WH/GN) FOR AN OPEN	

• Ignition OFF. • Disconnect: RH Front Window Motor C608. • Measure the resistance between the RH front window control switch, harness side and the RH front window motor, harness side as follows: **RH Front Window Control Switch Connector - Pin** / **RH Front Window Motor Connector - Pin** / **Circuit** C604-1 / C608-3 / 7S-AJ47 (YE/BK) C604-4 / C608-1 / 8-AJ56 (WH/GN) C604-6 / C608-4 / 7S-AJ48 (YE/VT)  • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new RH front window motor. REFER to Front Door Window Regulator and Motor in this section. INITIALIZE the RH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation. **No** REPAIR the circuit(s) as necessary. INITIALIZE the RH front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test D: A Single Power Window Is Inoperative — LH Rear or RH Rear

Normal Operation

The LH rear and RH rear window control switches receive a voltage input from the rear electronic module (REM) on circuit 7-AJ14 (YE/BU) (LH rear) and circuit 7-AJ24 (YE) (RH rear). The LH rear window control switch sends a passenger input command to the REM over circuits 8-AJ14 (WH/BU) (up) and 10-AJ14 (GY/VT) (down) while the RH rear window control switch sends a passenger input command to the REM over circuits 8-AJ24 (WH) (up) and 10-AJ24 (GY) (down). The REM appropriately applies voltage and ground over the LH rear window motor circuits 35-AJ13 (VT/BU) and 34-AJ13 (BU/RD) and over the RH rear window motor circuits 35-AJ23 (VT/WH) and 34-AJ23 (BU/OG) in order to operate the correct window motor in the commanded direction. These window motors are not smart motors and therefore have only proportional up/down operation with no one-touch feature.

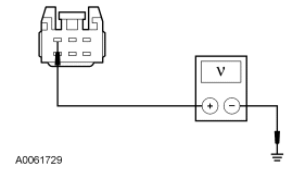
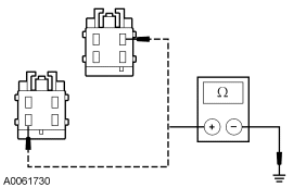
Possible Causes

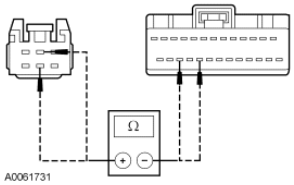
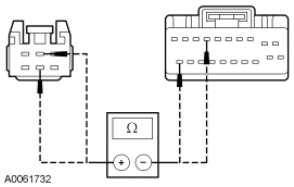
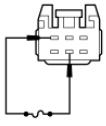
- circuit 7-AJ14 (YE/BU) open
- circuit 7-AJ24 (YE) open
- circuit 8-AJ14 (WH/BU) open
- circuit 8-AJ24 (WH) open
- circuit 10-AJ14 (GY/VT) open
- circuit 10-AJ24 (GY) open
- circuit 31-DK30 (BK/OG) open
- circuit 34-AJ13 (BU/RD) open
- circuit 34-AJ23 (BU/OG) open

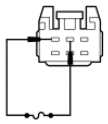
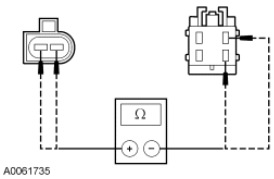
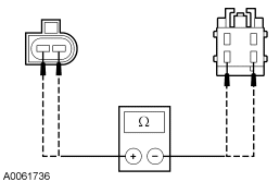
- circuit 35-AJ13 (VT/BU) open
- circuit 35-AJ23 (VT/WH) open
- LH or RH rear window control switch
- LH or RH rear window motor
- REM

PINPOINT TEST D: A SINGLE POWER WINDOW IS INOPERATIVE — LH REAR OR RH REAR

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
D1 CHECK THE VOLTAGE TO THE LH REAR OR RH REAR WINDOW CONTROL SWITCH	
• Ignition OFF. • Disconnect: Inoperative Rear Window Control Switch C701/C801. • Ignition ON. • **NOTE:** Make certain the window lock-out switch is in the UNLOCK position. • Measure the voltage between the inoperative rear window control switch C701-3, circuit 7-AJ14 (YE/BU) (LH rear), harness side and ground or C801-3, circuit 7-AJ24 (YE) (RH rear), harness side and ground.  A0061729 • **Is the voltage greater than 10 volts?**	**Yes** GO to D2 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D2 CHECK THE GROUNDS TO THE REM	
• Ignition OFF. • Disconnect: REM C420f, C420g. • Measure the resistance between the REM C420f-3, circuit 31-DK30 (BK/OG), harness side and ground; and between the REM C420g-2, circuit 31-DK30 (BK/OG), harness side and ground.  A0061730 • **Are the resistances less than 5 ohms?**	**Yes** GO to D3 . **No** REPAIR the circuit(s) as necessary. CLEAR the DTCs. REPEAT the self-test.

D3 CHECK CIRCUITS 8-AJ14 (WH/BU), 8-AJ24 (WH), 10-AJ14 (GY/VT) AND 10-AJ24 (GY) FOR AN OPEN	
• Disconnect: REM C420c, C420d. • **NOTE:** If the LH rear window motor is inoperative, follow Step 2. If the RH rear window motor is inoperative, follow Step 3. • If the LH rear window motor is inoperative, measure the resistance between the LH rear window control switch C701-5, circuit 8-AJ14 (WH/BU), harness side and the REM C420c-24, circuit 8-AJ14 (WH/BU), harness side; and between the LH rear window control switch C701-2, circuit 10-AJ14 (GY/VT), harness side and the REM C420c-22, circuit 10-AJ14 (GY/VT), harness side.  A0061731 • If the RH rear window motor is inoperative, measure the resistance between the RH rear window control switch C801-5, circuit 8-AJ24 (WH), harness side and the REM C420d-7, circuit 8-AJ24 (WH), harness side and between the RH rear window control switch C801-2, circuit 10-AJ24 (GY), harness side and the REM C420d-20, circuit 10-AJ24 (GY), harness side.  A0061732 • **Are the resistances less than 5 ohms?**	**Yes** GO to D4 . **No** REPAIR the circuit(s) as necessary. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK THE INOPERATIVE WINDOW CONTROL SWITCH	
• Connect: REM C420c, C420d, C420f, C420g. • Ignition ON. • Connect a fused (5A) jumper wire between the inoperative window control switch C701-3, circuit 7-AJ14 (YE/BU) (LH rear), harness side or C801-3, circuit 7-AJ24 (YE) (RH rear), harness side and C701-5, circuit 8-AJ14 (WH/BU) (LH rear), harness side or C801-5, circuit 8-AJ24 (WH) (RH rear), harness side. The window motor should operate in the up direction.  A0061733	**Yes** INSTALL a new rear window control switch. REFER to Window Control Switch in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to D5 .

• Connect a fused (5A) jumper wire between the inoperative window control switch C701-3, circuit 7-AJ14 (YE/BU) (LH rear), harness side or C801-3, circuit 7-AJ24 (YE) (RH rear), harness side and C701-2, circuit 10-AJ14 (GY/VT) (LH rear), harness side or C801-2, circuit 10-AJ24 (GY) (RH rear), harness side. The window motor should operate in the down direction.  A0061734 • **Does the window operate correctly?**	
D5 CHECK THE INOPERATIVE WINDOW MOTOR CIRCUITS	
• Ignition OFF. • Disconnect: REM C420f, C420g. • Disconnect: Inoperative Window Motor C703/C803. • **NOTE:** If the LH rear window motor is inoperative, follow Step 4. If the RH rear window motor is inoperative, follow Step 5. • Measure the resistance between the LH rear window motor C703-1, circuit 35-AJ13 (VT/BU), harness side and the REM C420f-1, circuit 35-AJ13 (VT/BU), harness side; and between C703-2, circuit 34-AJ13 (BU/RD), harness side and the REM C420f-2, circuit 34-AJ13 (BU/RD), harness side.  A0061735 • Measure the resistance between the RH rear window motor C803-1, circuit 35-AJ23 (VT/WH), harness side and the REM C420g-3, circuit 35-AJ23 (VT/WH), harness side; and between C803-2, circuit 34-AJ23 (BU/OG), harness side and the REM C420g-1, circuit 34-AJ23 (BU/OG), harness side.  A0061736 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new window motor. REFER to Rear Door Window Regulator and Motor in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit(s) as necessary. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The One-Touch Up/Down Feature Is Inoperative

NOTE: Excessive bounce-back (bounce-back that occurs with no obstructions present) may indicate a non-initialized window motor.

NOTE: The front window motors must be initialized whenever the following occurs: the motor is removed from the window regulator, a new motor is installed, a new window regulator is installed, a new window glass is installed, a glass top run removal and installation and when carrying out any operation in which grease or lubricants are applied to the window system. A new front window motor is in a proportional up/down mode until initialized.

NOTE: If this procedure is only partially completed, the front window motor remains non-initialized and only the proportional up/down functions operate. A non-initialized window motor may allow one-touch down operation, but does NOT allow one-touch up operation.

Normal Operation

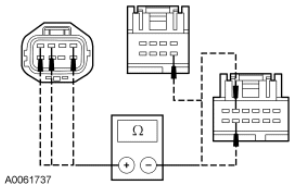
If the front window control switch is pressed (key ON) to the second detent, one-touch operation occurs in the commanded direction when voltage is sent from the front window control switch to the front window motor over circuit 8-AJ42 (WH/GN) (LF) or circuit 8-AJ56 (WH/GN) (RF).

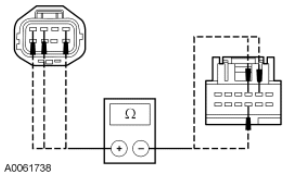
Possible Causes

- circuit 7S-AJ40 (YE/GN) open
- circuit 7S-AJ41 (YE/BK) open
- circuit 7S-AJ47 (YE/BK) open
- circuit 7S-AJ48 (YE/VT) open
- circuit 8S-AJ42 (WH/GN) open
- circuit 8S-AJ56 (WH/GN) open
- loss of B+ voltage (30-AJ80 [RD] [LH front], 30-AJ71 [RD/YE] [RH front]) to the smart window motor
- new smart window motor that has not been initialized
- new components that may affect the window travel
- window motor
- front window control switch

PINPOINT TEST E: THE ONE-TOUCH UP/DOWN FEATURE IS INOPERATIVE

Test Step	Result / Action to Take
E1 CHECK FOR B+ VOLTAGE LOSS DURING FRONT WINDOW OPERATION	
NOTE: If the window motor has one-touch-down operation with no one-touch-up operation and has been initialized, the smart window motor needs to be replaced and initialized. **NOTE:** The smart window motors are not on the multiplex link. • Verify if B+ voltage (30-AJ80 [RD] [LH front], 30-AJ71 [RD/YE] [RH front]) is lost during front window operation. • **Is B+ voltage lost during front window operation?**	**Yes** RAISE the front window to the fully closed position. MAKE SURE the window glass stalls into the upper header seal. Normal functionality should resume. TEST the system for normal operation. **No** GO to E2 .
E2 INITIALIZE THE FRONT WINDOW MOTOR	
• Ignition ON.	**Yes** The repair is complete. TEST the

• Carry out the front window motor initialization procedure. Refer to Door Window Motor Initialization in this section. • **Are the one-touch up/down functions operating correctly?**	system for normal operation. **No** GO to E3 .
E3 CHECK THE FRONT WINDOW CONTROL SWITCH FOR CORRECT OPERATION	
• Ignition OFF. • Disconnect: Front Window Control Switch. • Carry out the front window switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the front window control switch pass the component test?**	**Yes** GO to E4 . **No** INSTALL a new front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation.
E4 CHECK THE FRONT WINDOW SWITCH TO FRONT WINDOW MOTOR CIRCUITS	
• Disconnect: Front Window Motor C524/C608. • For the LH front window motor, measure the resistance between the LH front window motor C524-3, circuit 7S-AJ41 (YE/BK), harness side and the LH front window control switch C504b-5, circuit 7S-AJ41 (YE/BK), harness side; and between the LH front window motor C524-1, circuit 8-AJ42 (WH/GN), harness side and the LH front window control switch C504a-11, circuit 8-AJ42 (WH/GN), harness side; and between the LH front window motor C524-4, circuit 7S-AJ40 (YE/GN), harness side and the LH front window control switch C504a-5, circuit 7S-AJ40 (YE/GN), harness side.  • For the RH front window motor, measure the resistance between the RH front window motor C608-3, circuit 7S-AJ47 (YE/BK), harness side and the LH front window control switch C504a-3, circuit 7S-AJ47 (YE/BK), harness side; and between the RH front window motor C608-1, circuit 8-AJ56 (WH/GN), harness side and the LH front window control switch C504a-2, circuit 8-AJ56 (WH/GN), harness side; and between the RH front window motor C608-4, circuit 7S-AJ48 (YE/VT), harness side and the LH front window control switch C504a-9, circuit 7S-AJ48 (YE/VT), harness side.	**Yes** INSTALL a new front window motor. REFER to Front Door Window Regulator and Motor in this section. INITIALIZE the window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation. **No** REPAIR the circuit(s) as necessary. DE-INITIALIZE, then INITIALIZE the front window motor. REFER to Door Window Motor Initialization in this section. TEST the system for normal operation.

 A0061738 • **Are the resistances less than 5 ohms?**	

Pinpoint Test F: The Global Open/Close Feature Does Not Operate Correctly

Normal Operation

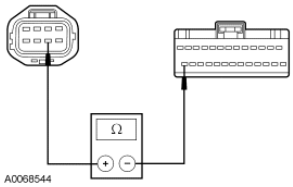
The LH and RH front window motors are energized by voltage on circuits 30-AJ80 (RD) and 31-AJ71 (RD/YE). The LH and RH front window motors are grounded through circuits 31-AJ80 (BK/OG) and 31-AJ71 (BK/YE). When the global open/close feature is activated the driver door module (DDM) sends a signal via circuit 8-AJ43 (GY/VT) to the LH and RH front window motors. The global open/close feature does not function when the delayed accessory is active. The roof opening panel performs global open/close with the windows (if equipped). A failure in the central locking system could cause the global open/close feature to be inoperative.

Possible Causes
- circuit 8-AJ43 (WH/BU) open
- DDM

PINPOINT TEST F: THE GLOBAL OPEN/CLOSE FEATURE DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
F1 VERIFY ALL POWER DOOR LOCKS ARE OPERATIONAL	
• Operate all of the door locks with the door key. • **Do all of the door locks operate with the door key?**	**Yes** GO to F2 . **No** REFER to Section 501-14 to diagnose the symptom all door locks are inoperative from the driver door lock cylinder.
F2 CHECK CIRCUIT 8-AJ43 (WH/BU) FOR AN OPEN	
• Disconnect: LH Front Window Motor C524. • Disconnect: RH Front Window Motor C608. • Disconnect: DDM C501d. • Measure the resistance between the LH front window motor C524-6, circuit 8-AJ43 (WH/BU), harness side and the DDM C501d-26, circuit 8-AJ43 (WH/BU), harness side; and between the RH front window motor C608-6, circuit 8-AJ43 (WH/BU), harness side and the DDM	**Yes** GO to F3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C501d-26, circuit 8-AJ43 (WH/BU), harness side.  • **Is the resistance less than 5 ohms on all circuits?**	
F3 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: The Defrost System Is Inoperative

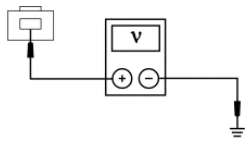
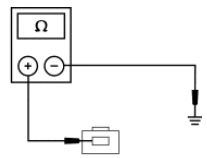
Normal Operation

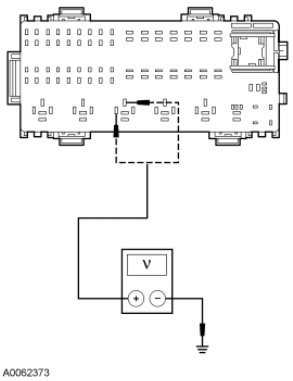
The heated rear window operates only when the engine is running. The heated rear window relay coil is grounded by the rear electronic module (REM) when the module receives a standard corporate protocol (SCP) bus signal from the digital automatic temperature control (DATC) module to turn on the heated rear window. The heated rear window relay has battery voltage to it at all times on circuit 30-HB23 (RD/WH). When the REM grounds the relay coil and closes the relay, it supplies voltage to the heated rear window over circuit 15S-DA13 (GN/YE) to circuit 15S-HB19 (GN/BU) through the heated rear window capacitor jumper circuit.

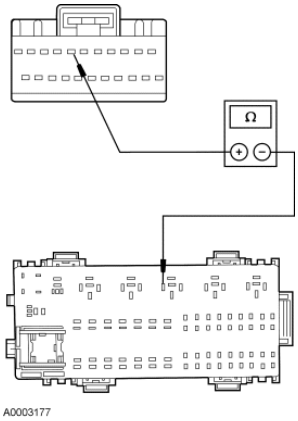
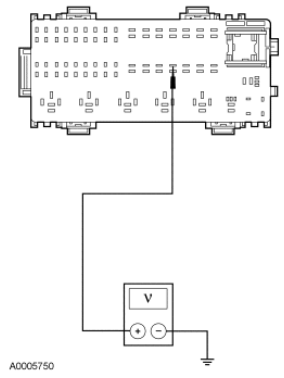
Possible Causes

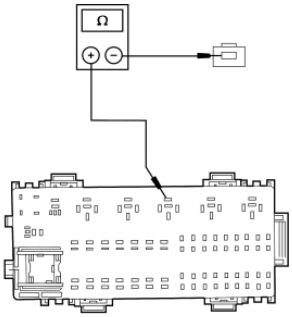
- fuse
- circuit 15S-DA13 (GN/YE) open
- circuit 15S-HB19 (GN/BU) open
- circuit 30-HB23 (RD/WH) open
- circuit 91S-HB23 (BN/WH) open
- heated rear window relay
- battery junction box (BJB)
- DATC module
- REM
- heated rear window capacitor jumper circuit

PINPOINT TEST G: THE DEFROST SYSTEM IS INOPERATIVE

Test Step	Result / Action to Take
G1 CHECK THE REM OUTPUT	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Active Commands. • Trigger the REM active command R_DEF_RLY to ON then OFF while listening for the heated rear window relay to click. • **Does the heated rear window relay click when activated ON and OFF?**	**Yes** GO to G2 . **No** VERIFY the BJB fuse 29 (40A) is OK. If OK, GO to G5 .
G2 CHECK THE HEATED REAR WINDOW VOLTAGE	
• Ignition OFF. • Disconnect: Heated Rear Window C402a. • Ignition ON. • While triggering the REM active command R_DEF_RLY to ON, measure the voltage between the heated rear window C402a, circuit 15S-HB19 (GN/BU), harness side and ground.  A0003178 • **Is the voltage greater than 10 volts?**	**Yes** GO to G3 . **No** GO to G9 .
G3 CHECK THE HEATED REAR WINDOW GROUND	
• Ignition OFF. • Disconnect: Heated Rear Window Ground C402b. • Measure the resistance between the heated rear window ground C402b-1, circuit 31-HB19 (BK/BU), harness side and ground.  A0003179 • **Is the resistance less than 5 ohms?**	**Yes** GO to G4 . **No** REPAIR the circuit. TEST the system for normal operation.
G4 CHECK THE HEATED REAR WINDOW GRID	
• Carry out the grid wire component test. Refer to Component Tests in this section.	**Yes** INSTALL a new DATC module. REFER to Section 412-01 . REPEAT the self-test.

• **Does the heated rear window grid pass the component test?**	If the heated rear window is still inoperative, GO to G11 . TEST the system for normal operation. **No** REPAIR the heated rear window grid. REFER to Lead Terminal Repair in this section. TEST the system for normal operation.
G5 CHECK THE VOLTAGE SUPPLY TO THE HEATED REAR WINDOW RELAY	
• Ignition OFF. • Disconnect: Heated Rear Window Relay C443. • Ignition ON. • Measure the voltage between the heated rear window relay C443-86, circuit 30-HB23 (RD/WH), harness side and ground; and between the heated rear window relay C443-30, circuit 30-HB23 (RD/WH), harness side and ground.  A0062373 • **Are the voltages greater than 10 volts?**	**Yes** GO to G6 . **No** GO to G8 .
G6 CHECK THE HEATED REAR WINDOW RELAY FOR CORRECT OPERATION	
• Check the heated rear window relay. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the heated rear window relay pass the component test?**	**Yes** GO to G7 . **No** INSTALL a new heated rear window relay. TEST the system for normal operation.
G7 CHECK CIRCUIT 91S-HB23 (BN/WH) FOR AN OPEN	

• Ignition OFF. • Disconnect: REM C420b. • Measure the resistance between the REM C420b-7, circuit 91S-HB23 (BN/WH), harness side and the heated rear window relay C443-85, circuit 91S-HB23 (BN/WH), harness side.  A0003177 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DATC module. REFER to Section 412-01 . REPEAT the self-test. If the heated rear window is still inoperative, GO to G11 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
G8 CHECK CIRCUIT 30-HB23 (RD/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: BJB Fuse 29 (40A). • Measure the voltage between the BJB fuse 29 (40A) input cavity and ground.  A0005750 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit 30-HB23 (RD/WH). TEST the system for normal operation. **No** REPAIR the BJB input circuit. TEST the system for normal operation.
G9 CHECK CIRCUIT 15S-HB19 (GN/BU) FOR AN OPEN	

• Ignition OFF. • Disconnect: Heated Rear Window Relay C443. • Measure the resistance between the heated rear window C402a-1, circuit 15S-HB19 (GN/BU) harness side and the heated rear window relay C443-87, circuit 15S-DA13 (GN/YE), harness side.  A0003180 • **Is the resistance less than 5 ohms?**	**Yes** GO to G10 . **No** REPAIR the circuit. TEST the system for normal operation.
G10 CHECK THE HEATED REAR WINDOW RELAY FOR CORRECT OPERATION	
• Check the heated rear window relay. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the heated rear window relay pass the component test?**	**Yes** REPAIR circuit 30-HB23 (RD/WH). TEST the system for normal operation. **No** INSTALL a new heated rear window relay. TEST the system for normal operation.
G11 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Defrost System Does Not Shut Off Automatically

Normal Operation

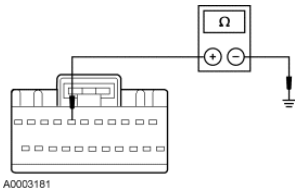
The heated rear window relay coil stays grounded by the rear electronic module (REM) for approximately 10 minutes, after which the REM removes the ground to circuit 91S-HB23 (BN/WH), thereby opening the heated rear window relay. This disconnects the voltage from circuits 15S-DA13 (GN/YE) and 15S-HB19 (GN/BU), which powers the heated rear window.

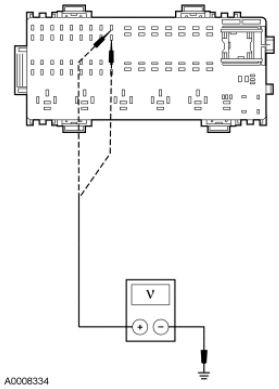
Possible Causes

- circuit 15S-DC1 (GN/YE) short to voltage
- circuit 29-HB1 (OG/YE) short to voltage
- circuit 91S-HB23 (BN/WH) short to ground
- heated rear window relay
- REM
- DATC module

PINPOINT TEST H: THE DEFROST SYSTEM DOES NOT SHUT OFF AUTOMATICALLY

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
H1 CHECK FOR A STICKING HEATED REAR WINDOW RELAY	
• Ignition OFF. • Disconnect: Heated Rear Window Relay C443. • Ignition ON. • **Is the heated rear window off?**	**Yes** GO to H2 . **No** GO to H4 .
H2 CHECK THE HEATED REAR WINDOW RELAY FOR CORRECT OPERATION	
• Ignition OFF. • Check the heated rear window relay. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the heated rear window relay pass the component test?**	**Yes** GO to H3 . **No** INSTALL a new heated rear window relay. TEST the system for normal operation.
H3 CHECK CIRCUIT 91S-HB23 (BN/WH) FOR A SHORT TO GROUND	
• Disconnect: REM C420b. • Measure the resistance between the REM C420b-7, circuit 91S-HB23 (BN/WH), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
H4 CHECK CIRCUITS 15S-DC1 (GN/YE), 29S-HB1 (OG/YE) FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Disconnect: BJB Fuse 9 (5A). • Ignition ON. • Measure the voltage between the BJB fuse 9 (5A) input cavity, circuit 15S-DC1 (GN/YE) and ground; and between the BJB fuse 9 (5A) output cavity, circuit 29S-HB1 (OG/YE) and ground.  • **Does circuit 15S-DC1 (GN/YE) have greater than 10 volts?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** REPAIR circuit 29S-HB1 (OG/YE). TEST the system for normal operation.
H5 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Defrost System Is Inoperative — Heated Wiper Park

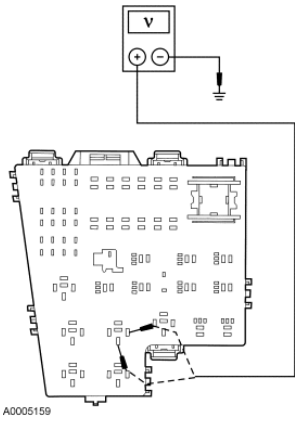
Normal Operation

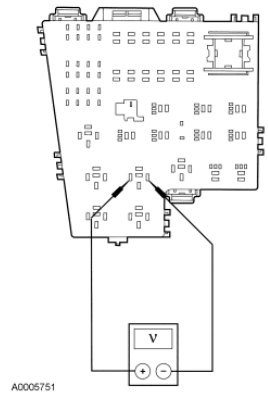
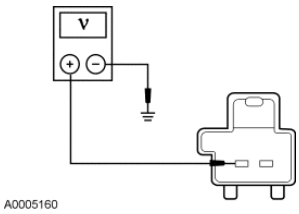
The heated wiper park relay is supplied voltage by the through circuits 30-HB8 (RD/OG). When the ambient temperature falls below 3°C (38°F), the digital automatic temperature control (DATC) module grounds circuit 91S-HB7 (BN/RD), closing the heated wiper park relay. This allows voltage to flow through circuit 30S-HB42 (RD/YE) to the heated wiper park grids in the windshield.

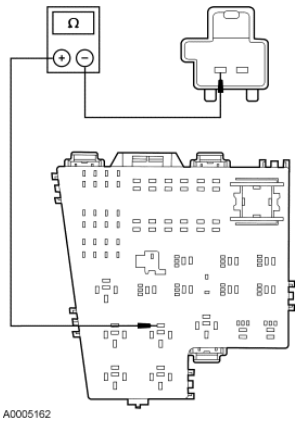
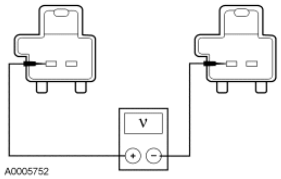
Possible Causes

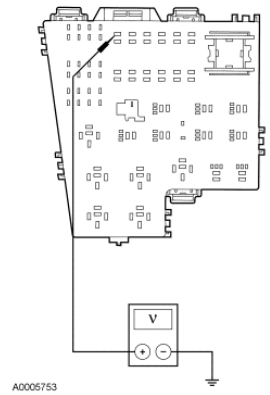
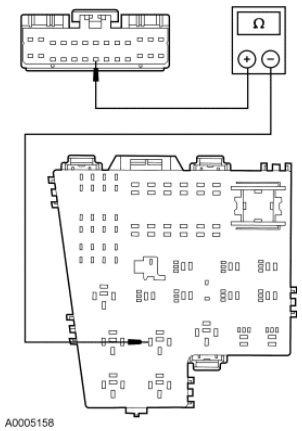
- fuse
- circuit 30-HB8 (RD/OG) open
- circuit 30S-HB42 (RD/YE) open
- circuit 31-HB42 (BK/YE) open
- circuit 91S-HB7 (BN/RD) open
- heated wiper park relay
- DATC module
- heated wiper park grids

PINPOINT TEST I: THE DEFROST SYSTEM IS INOPERATIVE — HEATED WIPER PARK

Test Step	Result / Action to Take
I1 CHECK THE VOLTAGE TO THE HEATED WIPER PARK RELAY	
• Ignition OFF. • Disconnect: Heated Wiper Park Relay C1014. • Measure the voltage between the heated wiper park relay C1014-86, circuit 30-HB8 (RD/OG), harness side and ground; and between the heated wiper park relay C1014-30, circuit 30-HB8 (RD/OG), harness side and ground.  • **Are both voltages greater than 10 volts?**	**Yes** GO to I2 . **No** VERIFY the underhood auxiliary junction box (AJB) fuse 13 (30A) is OK. If OK, GO to I6 .
I2 CHECK THE SWITCHED GROUND FROM THE DATC MODULE	
• Ignition ON. • Turn on the climate control. • **NOTE:** The heated wiper park remains on for 90 seconds. • Press the auto and defrost buttons simultaneously to turn on the heated wiper park. • Measure the voltage between the heated wiper park relay C1014-85, circuit 91S-HB7 (BK/BU), harness side and the heated wiper park relay C1014-86, circuit 30-HB8 (RD/OG), harness side.	**Yes** GO to I3 . **No** GO to I7 .

 • **Is the voltage greater than 10 volts?**	
I3 CHECK THE HEATED WIPER PARK RELAY OUTPUT	
• Ignition OFF. • Connect: Heated Wiper Park Relay C1014. • Disconnect: Heated Wiper Park C2272a. • Ignition ON. • Turn on the climate control. • **NOTE:** The heated wiper park remains on for 90 seconds. • Press the auto and defrost buttons simultaneously to turn on the heated wiper park. • Measure the voltage between the heated wiper park C2272a-1, circuit 30S-HB42 (RD/YE), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to I5 . **No** GO to I4 .
I4 CHECK CIRCUIT 30S-HB42 (RD/YE) FOR AN OPEN	
• Ignition OFF. • Disconnect: Heated Wiper Park Relay C1014. • Measure the resistance between the heated wiper park relay C1014-87, circuit 30S-HB42 (RD/YE), harness side and the heated wiper park C2272a-1, circuit 30S-HB42 (RD/YE), harness side.	**Yes** INSTALL a new heated wiper park relay. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

 A0005162 • **Is the resistance less than 5 ohms?**	
I5 CHECK THE HEATED WIPER PARK GROUND	
• Ignition OFF. • Disconnect: Heated Wiper Park C2272b. • Ignition ON. • Turn on the climate control. • **NOTE:** The heated wiper park remains on for 90 seconds. • Press the auto and defrost buttons simultaneously to turn on the heated wiper park. • Measure the voltage between the heated wiper park C2272a-1, circuit 30S-HB42 (RD/YE), harness side and the heated wiper park C2272b-1, circuit 31-HB42 (BK/YE), harness side.  A0005752 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new windshield. REFER to Windshield Glass in this section. TEST the system for normal operation. **No** REPAIR circuit 31-HB42 (BK/YE). TEST the system for normal operation.
I6 CHECK THE UNDERHOOD AJB FOR VOLTAGE	
• Disconnect: Underhood AJB Fuse 13 (30A). • Measure the voltage between the underhood AJB fuse 13 (30A) input cavity, and ground.	**Yes** REPAIR circuit 30-HB8 (RD/OG). TEST the system for normal operation. **No** REPAIR the underhood AJB input circuit. TEST the system for normal operation.

 • **Is the voltage greater than 10 volts?**	
I7 CHECK CIRCUIT 91S-HB7 (BN/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: DATC Module C228b. • Measure the resistance between the heated wiper park relay C1014-85, circuit 91S-HB7 (BN/RD), harness side and the DATC module C228b-20, circuit 91S-HB7 (BN/RD), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

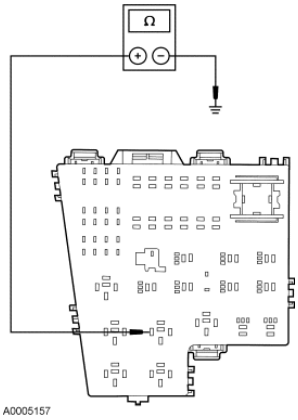
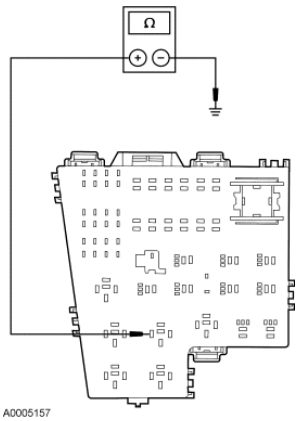
Pinpoint Test J: The Defrost System Does Not Shut Off Automatically — Heated Wiper Park

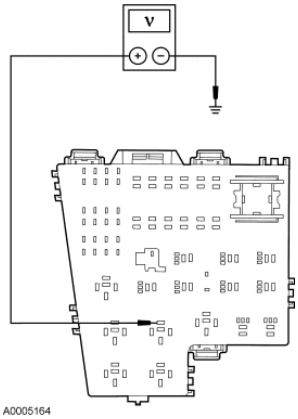
Normal Operation

The heated wiper park relay is supplied voltage by the AJB fuse 13 (30A) through circuit 30-HB8 (RD/OG). When the ambient temperature falls below 3°C (38°F), the module grounds circuit 91S-HB7 (BN/RD), closing the heated wiper park relay. This allows voltage to flow through circuit 30S-HB42 (RD/YE) to the heated wiper park grids in the windshield. The digital automatic temperature control (DATC) module automatically switches off when the ambient temperature rises above 3°C (38°F).

Possible Causes
- circuit 30S-HB42 (RD/YE) short to voltage
- circuit 91S-HB7 (BN/RD) short to ground
- heated wiper park relay
- DATC

PINPOINT TEST J: THE DEFROST SYSTEM DOES NOT SHUT OFF AUTOMATICALLY — HEATED WIPER PARK

Test Step	Result / Action to Take
J1 CHECK FOR A SHORTED CONTROL CIRCUIT	
• Ignition OFF. • Disconnect: Heated Wiper Park Relay C1014. • Measure the resistance between the heated wiper park relay C1014-85, circuit 91S-HB7 (BN/RD), harness side and ground.  A0005157 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to J3 . **No** GO to J2 .
J2 CHECK CIRCUIT 91S-HB7 (BN/RD) FOR A SHORT TO GROUND	
• Disconnect: DATC Module C228b. • Measure the resistance between the heated wiper park relay C1014-85, circuit 91S-HB7 (BN/RD), harness side and ground.  A0005157 • **Is the resistance greater 10,000 ohms?**	**Yes** INSTALL a new DATC module. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
J3 CHECK CIRCUIT 30S-HB42 (RD/YE) FOR A SHORT TO VOLTAGE	

• Ignition ON. • Measure the voltage between the heated wiper park relay C1014-87, circuit 30S-HB42 (RD/YE), harness side and ground.  A0005164 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new heated wiper park relay. TEST the system for normal operation.

Component Test

Grid Wire Test

1. Using a bright lamp in the vehicle, inspect the wire grid from the exterior. A broken grid wire appears as a brown spot.

2. Run the engine at idle. Set the rear window defrost switch to ON. The indicator light should come on.

3. Working in the vehicle with a voltmeter, contact the broad red-brown stripes of the rear glass window positive lead to battery side and the negative lead to ground side. The meter should read 10-13 volts. A lower voltage reading indicates a loose ground connection.

4. Contact a good ground point with the negative lead of the meter. The voltage reading should remain the same.

5. With the negative lead of the meter grounded, touch each grid line of the rear window defrost glass at its midpoint with the positive lead. A reading of approximately 6 volts indicates that the line is good. A reading of zero volts indicates that the line is broken between the midpoint and the B+ side of the grid line. A reading of 12 volts indicates that the circuit is broken between the midpoint of the grid line and ground.

Window Grid Wire Repair

Material

Item	Specification
Lacquer Touch-up Paint (match color to exterior grid wire) PM-19500-XXXXX or PMP-19500-XXXXX	ESR-M2P100-C
Polypropylene Film Fine Line Tape (commercially available)	—
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	—
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

NOTE: If the first layer of the heated rear window grid (brown) is damaged or missing, it is necessary to apply touch-up paint on the glass prior to applying the silver rear window defroster repair.

NOTE: The grid line material is not embedded into the glass but is baked to the glass surface and consequently can be scraped off. Inoperative lines may appear to the eye to be undamaged due to residue remaining on the glass and require diagnosis with a voltmeter or 12V test lamp. For additional information, refer to Diagnosis and Testing in this section.

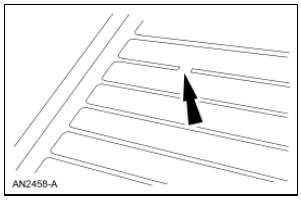
NOTE: An undamaged grid line has small ridges that project above the surface of the glass and can easily be felt when running a fingernail across them. Grid lines that have been "razor bladed" feel smooth when a fingernail is dragged across the affected area. There may be some residue left on the glass that appears to be grid material but a check with a voltmeter or 12V test lamp confirms an open circuit.

NOTE: If the brown color under the grid line is damaged or missing (this is very rare), it is necessary to apply acrylic lacquer touch-up paint for color match. This paint must meet specification ESR-M2P100-C and should be applied to the glass prior to applying the rear window defroster repair compound.

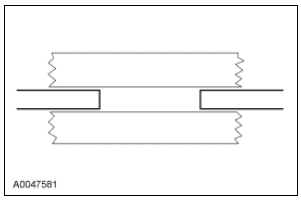
NOTE: The interior side of the grid lines are not painted, but due to the silver tarnishing tend to change the grid to a gold or brown color. The repair area is bright silver and tarnishes over time to match the rest of the grid.

1. Bring the vehicle up to a room temperature of at least 16°C (61°F) or above.
2. **NOTE:** Do not use scrapers, sharp instruments or abrasive window cleaners on the interior surface of the rear window glass as this may cause damage to the grid lines.

   Clean the entire grid line repair area with window cleaner and 0000 steel wool to remove all dirt, wax, grease, oil or other foreign material.
3. Mark the location of the grid break on the exterior of the rear window glass.



4. Using a polypropylene film fine line tape, mask the area directly above and below the grid break extending the tape 26 mm (1.02 in) beyond the concern area in both directions. The break area should be at the center of the mask.



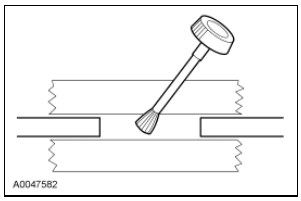
5. **NOTE:** If the brown layer is not broken or missing, apply only the silver grid repair compound to the break.

   NOTE: If both the brown and silver layers of the grid are broken or missing, apply a coating of the acrylic touch-up paint across the break in the grid line first. Do not overlap the silver grid line with the paint. Several applications may be necessary to achieve a color match.

   NOTE: Extend the silver repair coating at least 6.35 mm (0.25 in) on both sides of the break area.

   NOTE: Allow at least 5 minutes of drying time between applications for the touch-up paint or the silver repair coating. Applying fewer coats or not allowing adequate drying time between coats produces repaired resistance that is greater than OEM resistance, resulting in poor defrost performance and excessive localized heating.

   Apply the repair coating to the grid break area in several smooth, continuous strokes.
   Apply a minimum of 6 applications of the grid repair compound.



6. After 5 minutes, or after the repair area dries completely, remove the mask.

7. ⚠ **CAUTION: Be careful not to damage the grid line with the razor blade. If this occurs, additional repair may be necessary.**

   Remove any excess repair compound above or below the grid line with a razor blade.

8. **NOTE:** The repair coating air-dries in approximately 1 minute and can be energized after 5 minutes.

   NOTE: Optimum adhesion occurs after approximately 24 hours.

   Test the system for normal operation.

Lead Terminal Repair

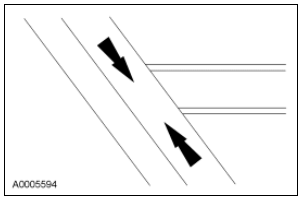
Material

Item	Specification
Terminal Kit - Back Glass 4F1Z-14421-AA	—
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. **NOTE:** The rear window glass must be at least 16°C (61°F) (room temperature) at the time of the repair.

   NOTE: The new terminal covers the original terminal location, but it must be placed so that the terminal conductive areas are placed on a good conductive base.

   Clean the bus bar in the area to be repaired with steel wool (3.0 to 4.0 grade), and then with window cleaner to remove all dirt, wax, grease, oil or other foreign matter.



2. ***NOTICE:*** **Do not use any type of flame torch or flame heated soldering gun for this procedure. Testing indicates inadequate heat generation at the tip and the exhaust heat can cause damage to plastic trim parts in the area. Use only an electric soldering gun with 100 watts or more of power. Before using the soldering gun, be sure to melt a small amount of rosin core solder to the tip. The solder assists in achieving better heat transfer from the soldering gun tip to the new terminal.**

   NOTE: The new terminal has pre-applied solder, flux and temperature-sensitive paint. The paint provides a visual indication when the terminal has reached the correct temperature to melt solder on the terminal. When the correct temperature is achieved the temperature paint liquefies and changes color.

   NOTE: Depending on the original terminal location, and whether the terminal is covered by pillar trim, determines where to locate the new terminal. Some grid line bus-bars may only allow the placement of the terminal above or below the original tab location due to space limitations. For most vehicle applications the replacement tab location covers the original tab location but still allows the replacement tab to attach to the bus-bar on good conductive material.

   Place the replacement terminal type A over the original tab location, making sure the conductive areas of the terminal are on a good conductive area. Do not place the terminal tab foot on the original location which does not have conductive material.

3. Hold the terminal in place with an item such as a regular lead pencil at a 90 degree angle from the terminal. (Holding at other than a 90 degree angle may allow the terminal to slip when the solder liquefies.)

4. Place the soldering gun tip on the top of the terminal but not on the painted areas of the tab. Energize the soldering gun and watch for the painted area of the terminal to liquefy and change color. The paint should liquefy in approximately 25-45 seconds after heating. As soon as the paint color completely changes on either side of the terminal, de-energize the soldering gun and continue to hold the terminal in place with the soldering gun and pencil for an additional 30 seconds.

5. Remove the soldering gun and pencil from the terminal. The terminal should be allowed to cool for another 2 minutes before the wiring lead is attached to the terminal.

6. Attach the electrical lead connection to this terminal, turn on the heated rear window and verify the operation.

Door Window Motor Initialization

NOTE: The front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

NOTE: A new (original factory setting) or de-initialized front window motor will not operate in one-touch up or one-touch-down mode until initialized. If a new front window motor has been installed, proceed to the initialization procedure.

NOTE: All front window components (window glass, window regulator, window motor, seals and glass top run) must be installed and tightened to specification before carrying out the initialization procedure.

NOTE: Excessive bounce-back (window reverses direction with no obstructions present) may indicate that a de-initialization procedure may need to be carried out.

De-Initialization procedure

NOTE: The front window motor must be reset to its original factory settings first, then carry out the following de-initialization procedure.

1. Turn the ignition key ON.

2. Operate the window control switch in one-touch mode and remove power from the window motor **while the window is moving** by one of the following methods:
    1. Disconnect the vehicle battery cable **while the window is moving** .
    2. Disconnect the window motor connector **while the window is moving** .
    3. Remove the LH or RH front window motor fuse **while the window is moving** .

3. This will de-initialize the window motor and reset the window motor to its original factory settings.

4. Carry out the initialization procedure to turn the one-touch-up feature on.

Initialization procedure

⚠ WARNING: Keep objects and body parts clear of the glass panel when carrying out the initialization procedure. During the initialization procedure, the glass panel closes with high force and cannot detect objects in its path. Failure to follow this instruction may result in serious personal injury.

NOTE: If the initialization procedure is only partially completed, the front window motor will remain un-initialized and will operate only in proportional up/down and one-touch-down modes.

5. Turn the ignition key ON.

6. Press and hold the window control switch in the UP position at the second detent until the window glass stalls for 2 seconds into the glass top run and release the switch.

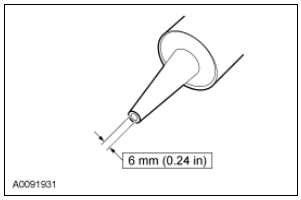
7. Test for correct window operation by carrying out the one-touch-up and one-touch-down features.

Windshield Reseal

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Urethane Adhesive Betaseal® Express	—
SIKA 2-HOUR CURE	
Urethane Adhesive Sika Tack ASAP	—

1. Remove the cowl grille panel. For additional information, refer to Section 501-02 .
2. Remove the 2 windshield mouldings. For additional information, refer to Windshield Moulding in this section.
3. Remove the screws and the 2 sun visors.
4. Remove the screws and the 2 sun visor clips.
5. Remove the 2 A-pillar trim panels.
6. Position the 2 front door weatherstrips aside.
7. If equipped, remove the 2 front passenger assist handles.
8. Partially lower the front portion of the headliner and block with a suitable material.
9. Clean the interior and exterior of the windshield glass surface with non-alcohol based glass cleaner.
10. Cut the urethane adhesive applicator tip to specification.



11. **NOTE:** Use either a high-ratio, electric or battery-operated caulk gun that applies the urethane with less effort and a continuous bead.

    NOTE: Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.

    Apply urethane adhesive over top of the existing urethane adhesive.

    - Apply the urethane to the top and sides of the windshield from the interior of the vehicle.
    - Apply the urethane to the bottom of the windshield from the exterior of the vehicle.

12. **NOTE:** The urethane adhesive must cure for a minimum of 1 hour before testing for air or water leaks.

    After the urethane has cured, check the windshield seal for air or water leaks through the urethane bead and add urethane adhesive as necessary.

13. Position the headliner.

14. If equipped, install the 2 front passenger assist handles.

15. Install the 2 front door weatherstrips.

16. Install the 2 A-pillar trim panels.

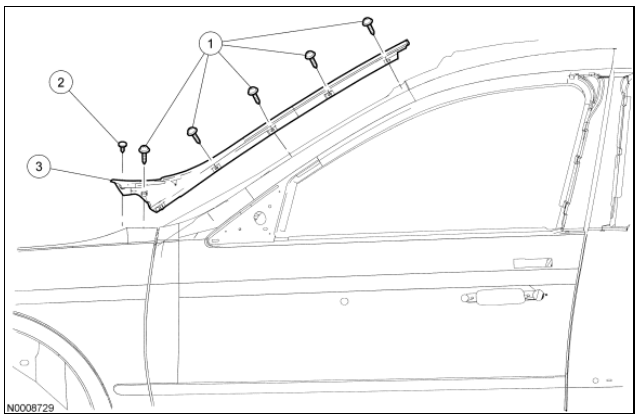
17. Install the 2 sun visor clips and screws.

18. Position the 2 sun visors and install the screws.
    - Connect the electrical connectors.

19. Install the 2 windshield mouldings. For additional information, refer to Windshield Moulding in this section.

20. Install the cowl panel grille. For additional information, refer to Section 501-02 .

Windshield Moulding



Item	Part Number	Description
1	384439	Windshield moulding screws (5 required)
2	—	Windshield moulding pin-type retainer
3	5403144	Windshield moulding

Removal and Installation

NOTE: The LH side is shown, the RH side is similar.

1. Remove the 5 windshield moulding screws.
2. Remove the pin-type retainer and the windshield moulding.
3. To install, reverse the removal procedure.

Windshield Glass

Special Tool(s)

ST1320-A	Deluxe Windshield Removal Tool 164-R2450 or equivalent
ST2085-A	The Pumper 164-R2459 or equivalent

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Urethane Adhesive Betaseal® Express	—
Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	—
SIKA 2-HOUR CURE	
Urethane Adhesive Sika Tack ASAP	—
Urethane Metal and Glass Primer Sika 206 G+P	—

Removal

⚠ **WARNING: To prevent glass splinters from entering the eyes or cutting the hands, wear safety glasses and heavy gloves when cutting the glass from the vehicle. Failure to follow these instructions may result in personal injury.**

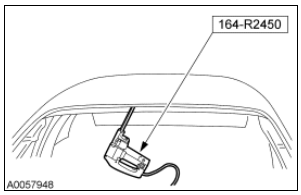
1. Remove the cowl panel grille. For additional information, refer to Section 501-02 .
2. Remove the windshield moulding. For additional information, refer to Windshield Moulding in this section.
3. Remove the interior rear view mirror. For additional information, refer to Section 501-09 .
4. If equipped, remove the rain sensor module.
5. Remove the 2 A-pillar trim panels.
6. Disconnect the windshield electrical connectors.
7. Lower the front portion of the headliner.
8. Using a soft brush or vacuum, remove dirt and foreign material from the pinch weld.
9. ***NOTICE:*** **Cover the instrument panel in order to prevent possible damage.**

NOTICE: **Care must be used to avoid scratching the pinch weld.**

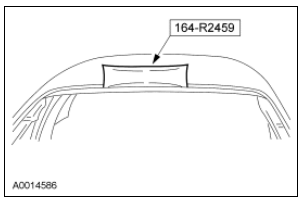
NOTE: Lubricate the existing urethane adhesive with water to aid the special tool while cutting.

NOTE: When cutting the foam inside, first cut the foam dam to access the urethane adhesive.

Using the special tool, starting at the top center of the windshield glass, cut the urethane adhesive away from the glass and work down the sides.



10. Using the special tool, distance the windshield from the body.



11. Remove the dual lock windshield glass stops from the sheet metal frame.
12. Using the special tool, cut the remaining urethane adhesive and remove the windshield.
13. Using a soft brush or vacuum, remove dirt and foreign material from the pinch weld.

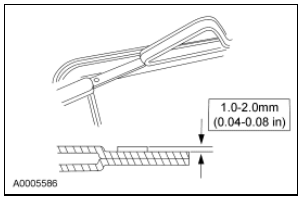
Installation

NOTICE: **When installing urethane-installed glass parts, the vehicle must not be driven until the urethane has cured. Adequate cure time is specified on the drive away chart for each urethane product as the temperatures and humidity vary. Inadequate or incorrect curing can adversely affect the retention of the windshield glass.**

NOTE: For additional material guidelines, refer to the manufacturer's installation information.

1. Dry fit the new windshield glass to the existing urethane bed on the body pinch weld. Align the windshield in the opening for uniform fit and adjust the setting blocks as needed for the best fit.
2. Use tape or non-permanent marking pencil to make alignment marks on the windshield glass (preferably at the setting blocks), and the body to aid in the installation alignment of the new windshield.
3. After alignment, remove the windshield glass and moulding from the vehicle and place them on a stable work surface.
4. **NOTE:** Avoid scratching the pinch weld. For minor scratches or exposed metal on the pinch weld, see the manufacturer's recommendations.

   Using an appropriate tool, trim the urethane adhesive leaving a 1-2Â mm (0.04-0.08Â in) base of the original equipment urethane on the pinch weld.



5. Clean the inside of the glass surface with an alcohol-free cleaner to make sure the ceramic-coated area is clean.

6. **NOTE:** If the moulding is already on the windshield glass, proceed to the next step.

   Align the "V" notch in the ceramic paint and windshield glass outside moulding at top center. Fully seat the windshield glass outside moulding along the top edge of the windshield glass and along the sides and bottom edges of the windshield glass.

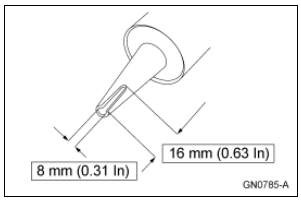
7. Remove the dual lock windshield glass stop adhesive backing.

8. ***NOTICE:*** **Be sure to use the same brand and cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Material Chart in this procedure.**

   NOTE: Sika uses the same black primer for the glass and pinch weld area.

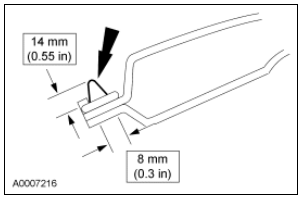
   If installing a new windshield glass, apply urethane glass primer according to the manufacturer's instructions. Allow at least 6 minutes to dry.

9. Cut the urethane adhesive applicator tip to specification.



10. **NOTE:** Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.

    Apply urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead starting and ending at the bottom of the windshield glass near the center.



11. ***NOTICE:*** **Open the windows to prevent the windshield glass from being pushed out by air pressure if a door is closed.**

    Install the windshield glass on the pinch weld. Align the windshield glass to the body using the alignment marks while pushing downward to set the stops.

12. ***NOTICE:*** **When installing urethane-installed glass parts, the vehicle must not be driven until the urethane has cured. Adequate cure time is specified on the drive away chart for each urethane product as the temperatures and humidity vary. Inadequate or incorrect curing can adversely affect the retention of the windshield.**

    After the urethane has cured, check the windshield seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.

13. Place 2 strips of tape onto the windshield glass and secure it to the roof panel. This helps avoid misalignment while the urethane cures.

14. Position the headliner.

15. Connect the windshield electrical connectors.

16. Install the 2 A-pillar trim panels.

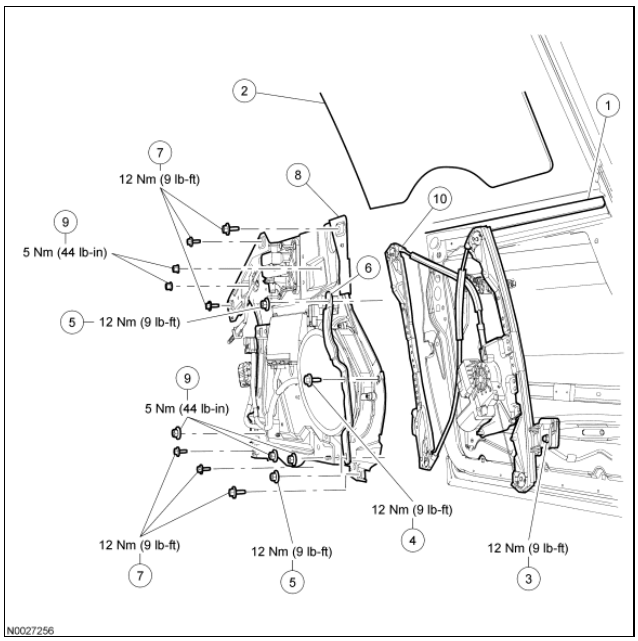
17. If equipped, install the rain sensor module.

18. Install the interior rear view mirror. For additional information, refer to Section 501-09 .

19. Install the windshield moulding. For additional information, refer to Windshield Moulding in this section.

20. Install the cowl panel grille. For additional information, refer to Section 501-02 .

Front Door Glass, Frames and Mechanisms — Exploded View



Item	Part Number	Description
1	5421456	Interior weatherstrip
2	5421410/ 5421411	Front door window glass (RH/LH)
3	—	Front door window regulator-to-glass clamp bolts (2 required) (part of 23210/23211)
4	—	Front door inner support bracket bolt
5	—	Front door inner support bracket nuts (2 required)
6	5421572/ 5421573	Front door inner support bracket (RH/LH)
7	N800510	Front door inner module assembly bolts (6 required)
8	54203A29	Front door inner module assembly
9	—	Front door window glass regulator nuts (5 required)
10	5423200/ 5423201	Front door window regulator (RH/LH)

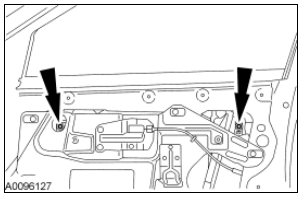
1. For additional information, refer to the procedures in this section.

Front Door Window Glass

Removal

NOTE: The front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run. For additional information, refer to Door Window Motor Initialization in this section.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Remove the watershield.
3. Remove the interior weatherstrip.
4. Connect the window control switch electrical connector.
5. Connect the battery. For additional information, refer to Section 414-01 .
6. Using the window control switch, position the front door window regulator-to-glass clamp bolts to align with the access holes.



7. Loosen the 2 front door window regulator-to-glass clamp bolts, allowing the window glass to move from the clamp.
8. Hold the glass in place, lower the front door window regulator to the full down position, and remove the front door window glass.

Installation

1. Position the front door window glass against the B-pillar.
2. **NOTE:** Make sure the front door window glass correctly seats in the glass mounting brackets as the front door window regulator is raised.

   Support the front door window glass and raise the front door window regulator to the full upright position.
3. Tighten the 2 front door window regulator-to-glass clamp bolts after the glass is fully seated in the clamp.
   - Tighten to 12 Nm (9 lb-ft).
4. Disconnect the battery. For additional information, refer to Section 414-01 .

5. Disconnect the window control switch electrical connector.

6. Install the interior weatherstrip.

7. Install the watershield.

8. Install the front door trim panel. For additional information, refer to Section 501-05 .

9. De-initialize, then initialize the front window motor. For additional information, refer to Door Window Motor Initialization in this section.

Front Door Window Regulator and Motor

Removal and Installation

NOTE: The front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run. For additional information, refer to Door Window Motor Initialization in this section.

1. Remove the front door window glass. For additional information, refer to Front Door Window Glass in this section.

2. Remove the front door inner support bracket bolt.
   - To install, tighten to 12 Nm (9 lb-ft).

3. Remove the 2 nuts and the front door inner support bracket.
   - To install, tighten to 12 Nm (9 lb-ft).

4. Remove the 6 front door inner module assembly bolts.
   - To install, tighten to 12 Nm (9 lb-ft).

5. If equipped, disconnect the remote keyless entry keypad electrical connector.

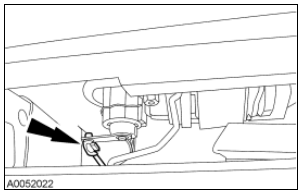
6. Disconnect the exterior mirror electrical connector and release the locators from the front door inner module assembly.

7. Disconnect the front door inner module assembly electrical connector, main wiring harness electrical connector and release the locators from the front door inner module assembly.

8. Remove the front door lower theft shield screw.
   - To install, tighten to 10 Nm (89 lb-in).

9. Remove the nut and the lower theft shield.

10. On the LH door, disconnect the door lock cylinder actuating rod.



11. Open the clip and disconnect the exterior door handle actuating rod.
    - If equipped, disconnect the door lock cylinder switch electrical connector.

12. Disconnect the front door latch electrical connector.

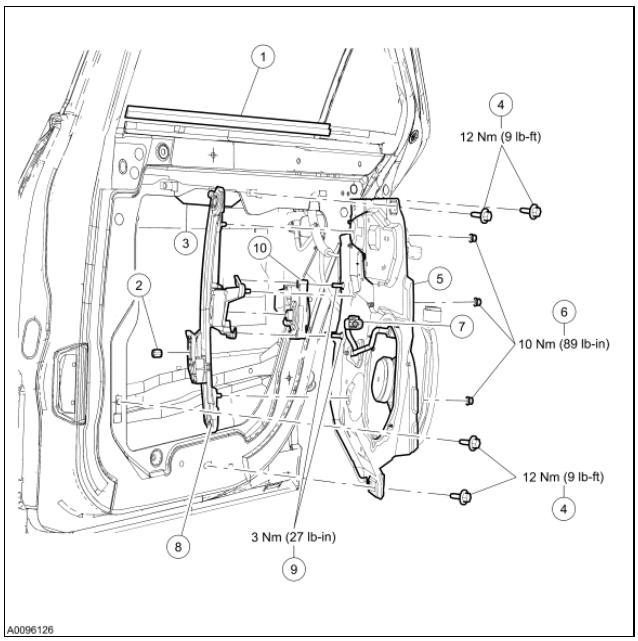
13. Remove the 3 door latch screws and position the door latch aside.
    - To install, tighten to 12 Nm (9 lb-ft).

14. Remove the front door inner module assembly.

15. Remove the 5 nuts and the front door window regulator.
    - To install, tighten to 5 Nm (44 lb-in).

16. To install, reverse the removal procedure.
    - Make sure the alignment dowels are seated before installing the inner door module bolts.
    - Tighten the inner door module bolts that are next to the alignment dowels first.
    - De-initialize, then initialize the front window motor. For additional information, refer to Door Window Motor Initialization in this section.

Rear Door Glass, Frames and Mechanisms — Exploded View



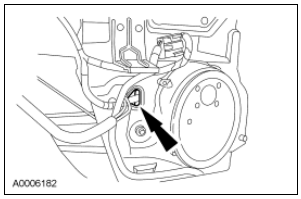
Item	Part Number	Description
1	5425860/ 5425861	Interior weatherstrip (RH/LH)
2	263A82	Retainer pin
3	5425712/ 5425713	Rear door window glass (RH/LH)
4	W707795	Rear door inner module assembly bolts (4 required)
5	5424994/ 5424995	Rear door inner module assembly (RH/LH)
6	N620480	Rear door window regulator nuts (3 required)
7	14A464	Rear door regulator motor electrical connector
8	5427009	Rear door window regulator
9	—	Rear door window regulator motor screws (3 required)
10	—	Rear door regulator motor

1. For additional information, refer to the procedures in this section.

Rear Door Window Glass

Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. Remove the watershield.
3. Connect the window control switch electrical connector.
4. Connect the battery. For additional information, refer to Section 414-01 .
5. Using the window control switch, position the rear door window glass to access the 2-part retainer.



6. Using a suitable tool, remove the center portion of the retainer pin and then the outer portion of the retainer pin.
7. Remove the rear door window glass.
8. **NOTE:** Prior to attaching the rear window glass to the regulator, reinstall the outer and center portions of the retainer pin into the rear door window glass. The retainer pin should protrude an equal distance on both sides of the window glass.

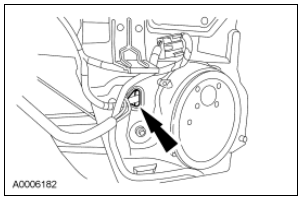
   To install, reverse the removal procedure.

   - Install the retainer pin into the rear door window glass.
   - Operate the rear door window regulator to the full up position until an audible click is heard when the retaining pin is engaged with the regulator.
   - Operate the rear door window glass and regulator to check for correct operation.

Rear Door Window Regulator and Motor

Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. Remove the watershield.
3. Remove the interior weatherstrip.
4. Connect the window control switch electrical connector.
5. Connect the battery. For additional information, refer to Section 414-01 .
6. Using the window control switch, position the rear door window glass to access the 2-part retainer.



7. Manually raise and support the glass in the full up position.
8. Remove the 4 bolts and the rear door inner module assembly.
   - To install, tighten to 12 Nm (9 lb-ft).
9. Disconnect the electrical connector.
10. Position the rear door inner module assembly aside to access the rear window regulator.
11. Remove the 3 rear door window regulator nuts.
    - To install, tighten to 10 Nm (89 lb-in).
12. Disconnect the rear door regulator motor electrical connector.
13. Remove the rear door window regulator.
14. **NOTE:** Prior to attaching the rear door window glass to the regulator, reinstall the outer and center portions of the retainer pin into the rear door window glass. The retainer pin should protrude an equal distance on both sides of the rear door window glass.

    To install, reverse the removal procedure.

    - Install the retainer pin into the rear door window glass.
    - Operate the rear door window regulator to the full up position until an audible click is heard when the retaining pin is engaged with the regulator.
    - Operate the rear door window glass and regulator for correct operation.

Rear Window Glass

Special Tool(s)

ST1320-A	Deluxe Windshield Removal Tool 164-R2450 or equivalent
ST2085-A	The Pumper 164-R2459 or equivalent

Material

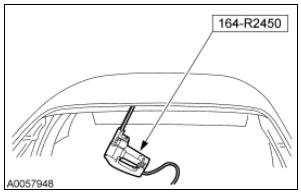
Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Urethane Adhesive Betaseal® Express	—
Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	—
SIKA 2-HOUR CURE	
Urethane Adhesive Sika Tack ASAP	—
Urethane Metal and Glass Primer Sika 206 G+P	—

Removal

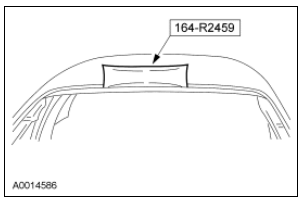
⚠ **WARNING: To prevent glass splinters from entering the eyes or cutting the hands, wear safety glasses and heavy gloves when cutting the glass from the vehicle. Failure to follow these instructions may result in personal injury.**

1. Remove the rear quarter trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the 3 rear window glass electrical connectors.
3. Lower the rear portion of the headliner.
4. Using a soft brush or vacuum, remove the dirt and foreign material from the pinch weld.
5. **NOTE:** Lubricate the existing urethane adhesive with water to aid the special tool while cutting.

   Using the special tool, starting at the top center of the rear window glass, cut the urethane adhesive away from the glass and work down the sides.



6. Using the special tool, distance the rear window glass from the body.



7. Using the special tool, cut the remaining urethane adhesive and remove the rear window glass.

8. Using a soft brush or vacuum, remove the dirt and foreign material from the pinch weld.

Installation

NOTICE: **When installing urethane-installed glass parts, the vehicle must not be driven until the urethane has cured. Adequate cure time is specified on the drive away chart for each urethane product as the temperatures and humidity vary. Inadequate or incorrect curing can adversely affect the retention of the rear window glass.**

NOTE: For additional material guidelines, refer to the manufacturer's installation information.

1. Dry fit the rear window glass to the existing urethane bed on the body pinch weld. Align the rear window glass in the opening for a uniform fit.

2. Use tape or non-permanent marking pencil to make alignment marks on the rear window glass (preferably at the setting blocks), and the body to aid in the installation alignment of the rear window glass.

3. After alignment, remove the rear window glass and moulding from the vehicle and place them on a stable work surface.

4. **NOTE:** Avoid scratching the pinch weld. For minor scratches or exposed metal on the pinch weld, see the manufacturer's recommendations.

   Using an appropriate tool, trim the urethane adhesive leaving a 1-2Â mm (0.04-0.08Â in) base of the original equipment urethane on the pinch weld.

5. If reinstalling the original rear window glass, remove any excess urethane adhesive.

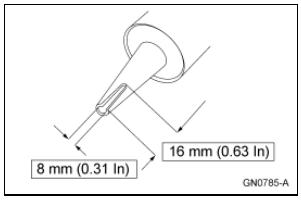
6. Clean the inside of the rear window glass surface with an alcohol-free cleaner to make sure the ceramic-coated area is clean.

7. ***NOTICE:*** **Be sure to use the same brand and cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Material Chart in this procedure.**

   NOTE: Sika uses the same black primer for the glass and pinch weld area.

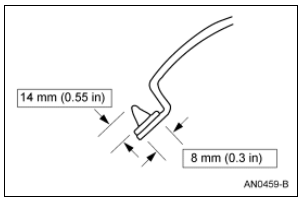
   If installing a new rear window glass, apply urethane glass primer according to the manufacturer's instructions. Allow at least 6 minutes to dry.

8. Cut the urethane adhesive applicator tip to specification.



9. **NOTE:** Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.

   Apply urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead starting and ending at the bottom of the rear window glass near the center.



10. ***NOTICE:*** **Open the windows to prevent the rear window glass from being pushed out by air pressure if a door is closed.**

    Install the rear window glass on the pinch weld. Align the rear window glass to the body using the alignment marks while pushing downward to set the stops.

11. ***NOTICE:*** **When installing urethane-installed glass parts, the vehicle must not be driven until the urethane has cured. Adequate cure time is specified on the drive away chart for each urethane product as the temperatures and humidity vary. Inadequate or incorrect curing can adversely affect the retention of the rear window glass.**

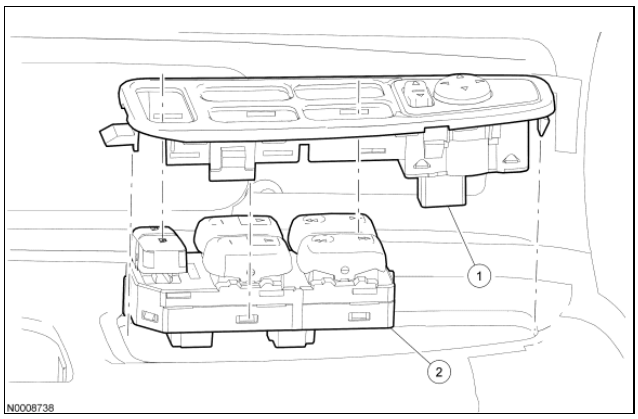
    After the urethane has cured, check the rear window glass seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.

12. Position the headliner.

13. Connect the 3 rear window glass electrical connectors.

14. Install the quarter trim panel. For additional information, refer to Section 501-05 .

Window Control Switch



Item	Part Number	Description
1	14527	Window control switch bezel
2	14529	Window control switch

Removal and Installation

NOTE: The LH front window control switch is shown, all others are similar.

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. Carefully lift out the window control switch and bezel from the front of the door panel to avoid breaking the tab.
3. Disconnect the window control switch electrical connector.
4. Remove the window control switch from the window control switch bezel.
5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Floor console nut	8	—	71
Floor console rear screws	4	—	35
Glove compartment door bolts	5	—	44
Instrument panel cowl side bolts	20	15	—
Instrument panel cowl side nuts	20	15	—
Instrument panel cowl top bolts	20	15	—
Instrument panel tunnel brace bolts	20	15	—
Instrument panel steering column reinforcement screw	3	—	27
Instrument panel steering column reinforcement screws	9	—	80
Intermediate shaft pinch bolt	35	26	—

Instrument Panel

Instrument Panel

The instrument panel consists of the following components:

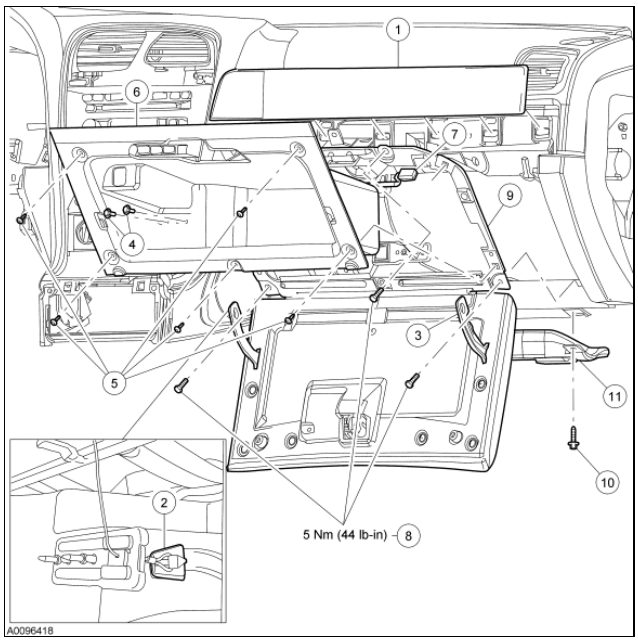
- passenger air bag module
- instrument panel cluster finish panel
- glove compartment
- audio unit
- climate control unit
- instrument panel finish panels
- instrument panel defroster opening grille
- instrument panel steering column cover reinforcement
- instrument panel steering column cover

Console

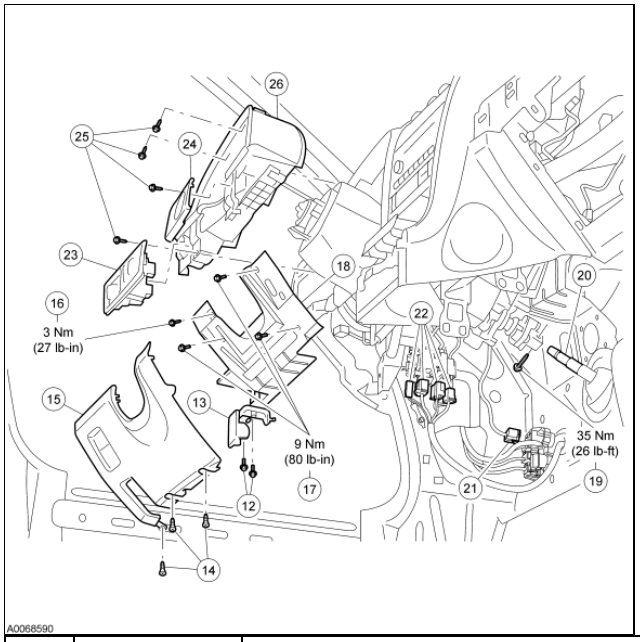
Console

The floor console houses the electronic parking brake, traction/advance trac switch, auxiliary power point, 2 cup holders and extra storage space in the rear of the passenger compartment. The overhead console incorporates 2 interior lights with switches, the roof opening panel switch and the parking aid switch.

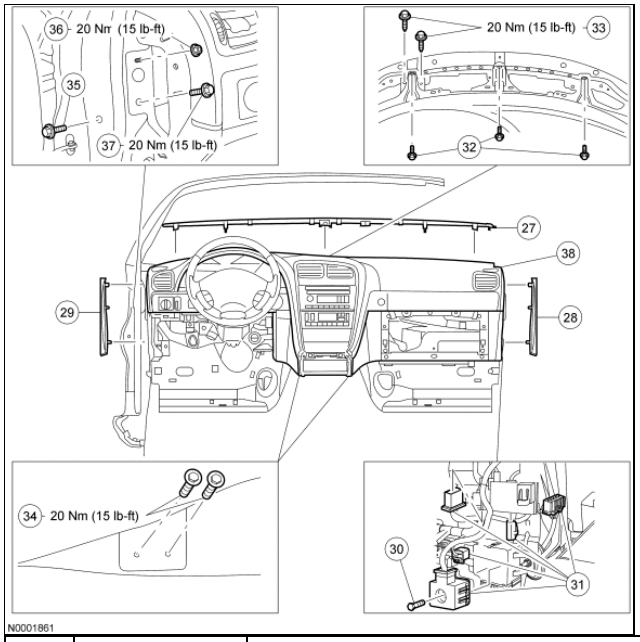
Instrument Panel — Exploded View



Item	Part Number	Description
1	04338C	Instrument panel trim panel
2	—	Glove compartment arm assist cable
3	—	Glove compartment assist arm (part of 06024)
4	—	Glove compartment assist cable bracket screws (2 required)
5	W704734	Glove compartment screws (5 required)
6	—	Glove compartment bin (part of 06024)
7	—	Glove compartment lamp electrical connector (part of 14401)
8	—	Glove compartment door bolts (5 required)
9	06010	Glove compartment door frame (part of 06024)
10	W704874	Floor heat duct bolt
11	18C298	Floor heat duct



Item	Part Number	Description
12	—	Hood release handle screws (2 required) (part of 16B975)
13	16B975	Hood release handle
14	—	Steering column cover pin-type retainers (3 required)
15	04459	Instrument panel steering column reinforcement cover
16	N807122	Instrument panel steering column reinforcement screw
17	W503924	Instrument panel steering column reinforcement screws (3 required)
18	04680	Instrument panel steering column reinforcement
19	—	Intermediate shaft pinch bolt
20	3C662	Intermediate shaft
21	14401	Instrument panel harness electrical connector (part of 14401)
22	14401	Instrument panel harness electrical connectors (part of 14401)
23	04338A	Outer instrument panel finish panel
24	04338B	Inner instrument panel finish panel
25	—	Instrument cluster finish panel screws (4 required)
26	044D70	Instrument cluster finish panel



Item	Part Number	Description
27	044E82	Instrument panel defroster grille
28	04338D	RH side instrument panel trim panel
29	04338E	LH side instrument panel trim panel
30	—	Instrument panel harness bulk head electrical connector bolt
31	—	Instrument panel harness electrical connectors (part of 14401)
32	W705392	Instrument panel cowl top screws (3 required)
33	W704801	Instrument panel cowl top bolts (2 required)
34	W704801	Instrument panel tunnel brace bolts (4 required)
35	W705489	Instrument panel cowl side bolt (LH side only)
36	N806423	Instrument panel cowl side nuts (2 required)
37	W704801	Instrument panel cowl side bolts (2 required)
38	04304	Instrument panel

1. For additional information, refer to the procedures in this section.

Glove Compartment

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. Remove the instrument panel trim panel.
3. Remove the RH floor duct screw.
4. Detach the RH courtesy lamp socket.
5. Remove the RH floor duct.
6. Release the glove compartment arm assist cable from the assist arm.
7. Lift up on the glove compartment door assist arms and lower the glove compartment.
8. Remove the 2 glove compartment assist cable bracket screws.
9. Remove the 5 screws and the glove compartment bin.
10. Disconnect the glove compartment lamp electrical connector.
11. Remove the 5 bolts and the glove compartment door frame.
    - To install, tighten to 5 Nm (44 lb-in).
12. To install, reverse the removal procedure.

Steering Column Cover

1. Remove the 2 screws and position the hood release handle aside.

2. Remove the 3 pin-type retainers and the instrument panel steering column reinforcement cover.

3. If necessary, remove upper LH instrument panel steering column reinforcement screw.
   - To install, tighten to 3 Nm (27 lb-in).

4. If necessary, remove the 3 screws and the instrument panel steering column reinforcement.
   - To install, tighten to 9 Nm (80 lb-in).

5. To install, reverse the removal procedure.

Instrument Cluster Finish Panel

1. Adjust the steering column to the full tilt down and full extended position.
2. Disconnect the battery. For additional information, refer to Section 414-01 .
3. Remove the 3 pin-type retainers and the instrument panel steering column reinforcement cover.
4. Remove the outer instrument panel finish panel.
    - Disconnect the electrical connectors.
5. Remove the inner instrument panel finish panel.
6. Remove the 4 screws and instrument cluster finish panel
7. To install, reverse the removal procedure.

Instrument Panel

Removal and Installation

NOTE: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

1. Depower the supplemental restraint system (SRS). For additional information, refer to Section 501-20B .
2. Remove the floor console. For additional information, refer to Floor Console in this section.
3. Remove the transmission range selector lever. For additional information, refer to Section 307-05 .
4. Remove the LH and RH front door scuff plates.
5. Position the LH and RH front door weatherstrip aside.
6. Remove the LH and RH A-pillar lower trim panels.
7. Remove the upper A-pillars.
8. Remove the 2 screws and position the hood release handle aside.
9. Disconnect the LH instrument panel harness electrical connectors.
10. Remove the 3 pin-type retainers and the instrument panel steering column reinforcement cover.
11. Instrument panel steering column reinforcement screws and the instrument panel steering column reinforcement.
    - To install, tighten to 9 Nm (80 lb-in).
12. Disconnect the instrument panel harness electrical connectors.
13. ⚠ **CAUTION: Secure the steering wheel to prevent any rotation or damage to the air bag sliding contact.**

    Remove the pinch bolt and separate the intermediate shaft from the steering column.

    - To install, tighten to 35 Nm (26 lb-ft).
14. Remove the screw and the RH floor heat duct.
15. Loosen the bolt and disconnect the RH instrument panel bulkhead electrical connector.
16. Disconnect the RH instrument panel harness electrical connectors.
17. Remove the instrument panel defroster opening grille.
    - Disconnect the electrical connector.
18. Remove the 3 instrument panel cowl top screws.

19. Remove the LH and RH instrument panel side finish panels.

20. Remove the 2 instrument panel cowl top bolts.
    - To install, tighten to 20 Nm (15 lb-ft).

21. Position the carpet aside, and remove the 4 instrument panel tunnel brace bolts.
    - To install, tighten to 20 Nm (15 lb-ft).

22. Remove the 2 LH instrument panel cowl side bolts and nut.
    - To install, tighten to 20 Nm (15 lb-ft).

23. Remove the RH instrument panel cowl side bolt and nut.
    - To install, tighten to 20 Nm (15 lb-ft).

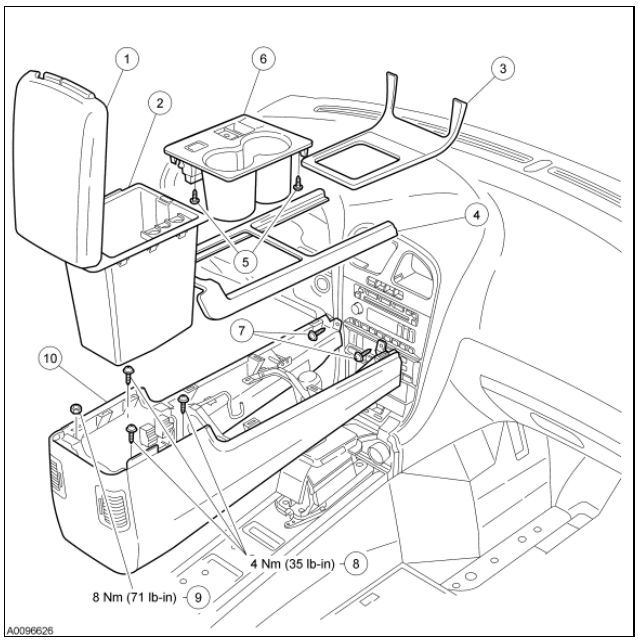
24. Position the carpet aside and disconnect the LH junction box electrical connector.

25. **NOTE:** Two technicians are required to carry out this step.

    Remove the instrument panel.

26. To install, reverse the removal procedure.

Floor Console



Item	Part Number	Description
1	060024	Floor console armrest
2	06010	Floor console storage bin
3	04338D	Floor console finish panel (front)
4	044D90	Floor console finish panel (center)
5	—	Floor console cup holder screws (2 required)
6	13562	Floor console cup holder
7	—	Floor console front screws (2 required)
8	—	Floor console rear screws (3 required)
9	—	Floor console nut
10	045A36	Floor console

Removal and Installation

1. Position the seats as needed to remove the console.

2. Disconnect the battery. For additional information, refer to Section 414-01 .

3. Remove the floor console storage bin.
    1. Remove the 3 screws and the armrest.
    2. Remove the floor console storage bin screw.
    3. Remove the pin-type retainer.
    - Disonnect the electrical connectors.

4. Remove the floor console front finish panel.
    - Pull upward from the front of the trim panel to release the retainers.
    - Disconnect the electrical connectors.

5. Remove the floor console center finish panel.

6. If necessary, remove the 2 screws and the floor console cup holder.

7. Remove the 2 floor console front screws.

8. Remove the 3 floor console rear screws.
    - To install, tighten to 4 Nm (35 lb-in).

9. **NOTE:** Lift the console from the rear and slide it rearward to release the rear seat heater ducts from the instrument panel.

   Remove the nut and the floor console.

    - Disconnect the electrical connector.
    - To install, tighten to 8 Nm (71 lb-in).

10. To install, reverse the removal procedure.

General Specifications

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

Lock Repair/Replacement Specifications

Lock Repair Package Name	Part Number
Door Lock Kit	F87Z-1521990-BA
Ignition Cylinder Lock Kit	F85Z-11582-AA
Lock Lever Kit	F8DZ-5421970â— AA

Torque Specifications

Description	Nm	lb-ft	lb-in
Door latch screws	12	9	—
Door lock cylinder nut	10	—	89
Exterior door handle nut	10	—	89
Front door latch shield nut	10	—	89
Front door latch shield screw	10	—	89
Hood latch bolts	12	9	—
Luggage compartment lid latch bolts	10	—	89
Luggage compartment lid lock cylinder nuts	10	—	89

Handles, Locks, Latches and Entry Systems

The hood latch system consists of 1 latch controlled by the hood release handle under the lower steering column cover.

The door latch system consists of a primary latch, fastened to the inside of the door frame, that is controlled by the exterior and interior door handles. The door latch system has an integrated door ajar switch, door lock actuator, and a driver set/reset switch (driver door only). The door locks are actuated by either a remote keyless entry (RKE) transmitter, the interior door lock/unlock switch (located on the driver and passenger door trim panels), manually inserting the key into the driver door lock cylinder to lock/unlock, or using the RKE keypad.

The luggage compartment lid latch is equipped with an interior release handle and an actuator. The luggage compartment lid can be locked and unlocked using the lock cylinder (the valet key does not fit the lock cylinder), the luggage compartment interior trim remote switch (the remote switch opens the luggage compartment lid if it is not in the lock position), the RKE transmitter, and the RKE keypad.

The RKE transmitter communicates with the driver door module (DDM), which controls the output functions of the driver door lock actuator. The DDM communicates through the standard corporate protocol (SCP) link to the rear electronics module (REM) and the front electronic module (FEM) for the lock and unlock commands. The REM controls the output function of the luggage compartment lid actuator and the passenger door actuators. The REM is located in the RH rear side of the luggage compartment.

The RKE keypad remote entry feature allows the following functions to be carried out:

- unlock the driver door (when 2-stage unlocking is enabled)
- unlock all doors
- lock all doors
- arm the security system
- disarm the security system
- reset a panic alarm
- recall the memory seat/mirrors/steering column/pedals position associated with a particular remote entry device (when enabled)
- release the luggage compartment lid actuator
- global open

The RKE keypad remote entry feature also illuminates the RKE keypad lamp and issues illuminated entry on/off requests to the DDM, when locking and unlocking. The keyless entry keypad is wired to the DDM which controls the output functions of the driver door lock. The DDM then communicates with the REM which controls the output functions of the passenger door locks and the luggage compartment lid.

⚠ WARNING: Disconnect the battery ground cable when working on or near the driver side door cylinder lock rod or door latch. Failure to follow these instructions may result in personal injury.

The global open/close feature is controlled by the DDM. The global open feature involves the DDM either receiving a signal from the door lock cylinder being held in the UNLOCK position for two seconds or the DDM receives a signal from a remote transmitter (when the customer holds the UNLOCK button on the transmitter for two seconds to activate the feature) and sends a voltage signal to the LH front, RH front smart window motors and the smart roof opening panel motor (if equipped). The smart window motors and smart roof opening panel motor will carry out a global open (simultaneous opening of the front windows and roof opening panel). Pressing any button on the remote transmitter, or actuating the door lock cylinder to the

UNLOCK or LOCK position will interrupt the global open function.

When any new lock cylinder is installed, the luggage compartment lid lock cylinder, the driver door lock cylinder and ignition lock cylinders should be installed as a set. This eliminates carrying an extra key which fits only 1 lock. If a new key is used, the new key code number is stamped on a metal tag attached to the key.

Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Locks, Latches and Entry Systems

Refer to Wiring Diagrams Cell 110 for schematic and connector information.

Refer to Wiring Diagrams Cell 113 for schematic and connector information.

Refer to Wiring Diagrams Cell 116 for schematic and connector information.

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

Rear Electronic Module (REM)

The REM controls the output functions of the passenger door lock actuators and the luggage compartment lid actuator.

Locking and Unlocking

The driver door lock function is controlled by the driver door module (DDM).

The passenger door locks and the luggage compartment lid actuator functions are controlled by the REM.

The passenger lock/unlock actuators are hardwired to the REM.

Smart Lock

The smart lock feature is controlled by the REM. This feature prevents the operator from accidentally locking the vehicle with the key in the ignition lock cylinder. The REM receives the key-in-ignition status from the instrument cluster and the driver and passenger door ajar status from the front electronic module (FEM)

before this feature can function. If the key is in the ignition switch, the driver door is ajar, and an attempt is made to lock the vehicle with the driver door lock control switch, all the doors lock and the driver door unlocks. If the key is in the ignition, the passenger door is ajar, and an attempt is made to lock the vehicle with the passenger door lock control switch, all the doors lock and then all the doors unlock.

Autolock

The autolock feature is controlled by the REM. This feature locks the doors whenever the vehicle is being driven. This feature uses inputs from the ignition switch, the digital transmission range (TR) selector, the brake pedal position (BPP) sensor, and the driver and passenger door ajar switch status. The autolock function works when the following conditions are concurrently met during the current ignition cycle:

- all the doors are closed
- the autolock function is active (this function has not been disabled through the message center or any programmable options)
- the key is in the RUN position
- the transmission is in any forward gear, or reverse
- the vehicle speed exceeds 5 km/h (3 mph)

The autolocks are activated again if at least one door has been opened and closed since the last auto lock function and the following conditions are met:

- the autolock function is active (this function has not been disabled through the message center or any programmable options)
- the key is in the RUN position
- the transmission is in any forward gear, or reverse
- the vehicle speed exceeds 5 km/h (3 mph)
- all the doors are closed

Interior Power Lock/Unlock

The power lock/unlock function is independent of the ignition switch position. Power lock of all doors is accomplished by:

- the driver or passenger door lock control switch
- a lock command from the remote keyless entry (RKE) transmitter
- a lock command from the driver set/reset switch (part of the door latch)
- the keyless entry keypad

If the perimeter alarm is armed, the interior luggage compartment lid release and door lock control switches are disabled. Disarming the alarm (through valid unlock commands) enables the switches.

When the LOCK button on the RKE transmitter is pressed once, the power lock function initiates the locking of all doors. If pressed twice and all doors, luggage compartment lid, and hood are closed, then the horn chirps once (if horn chirp is enabled). If pressed twice and any door, luggage compartment lid or hood is open/ajar then the horn chirps twice (if horn chirp is enabled). If 2-step unlocking is enabled, the driver door unlocks on the first occurrence of one of the following events with no other identical UNLOCK events in the past 5 seconds:

- a command from the RKE transmitter
- a command from the driver set/reset switch (part of the door latch)
- a command from the keyless entry keypad

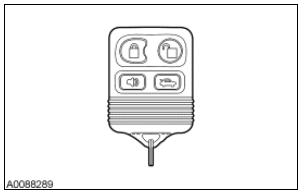
When 2-step unlocking is enabled, if a subsequent unlock event of the same type occurs within 5 seconds without the doors being relocked, all the doors unlock. When 2-step unlock is disabled, all doors unlock at the first (and all subsequent) unlock commands. Refer to Stepped Unlock Programming in this section for programming information.

Luggage Compartment Lid

The luggage compartment lid feature is controlled by the FEM and the REM. The luggage compartment lid release switch is hardwired to the FEM. When the switch is active, the FEM sends a command to the REM through the standard corporate protocol (SCP) communication network. The REM also needs the vehicle speed status (must be less than 5 km/h [3 mph]) from the network in order to activate the luggage compartment lid actuator. The REM also activates the luggage compartment lid actuator by a command from the DDM through the SCP communication network (RKE transmitter or keyless entry keypad).

Remote Keyless Entry (RKE)

The door locks and luggage compartment lid can be operated by the RKE transmitter. When a command is received from the RKE transmitter, the DDM sends a command to the FEM or the REM to unlock a door or unlatch the luggage compartment lid.



The RKE transmitter initiates the following electronic system functions:

- opens the trunk
- unlocks the driver door (if 2-step unlock is enabled)
- unlocks all doors
- locks all doors
- activates/deactivates the panic alarm
- commands the interior lamps on (when unlocking) and off (when locking)
- sounds the horn once when LOCK is pressed twice within 3 seconds and the doors, the hood, and the trunk are closed
- sounds the horn twice when the LOCK button is pressed twice within 3 seconds and any door, the hood, or the trunk is open

The RKE transmitter has a minimum acceptable operating range of 10 m (33 feet).

The RKE transmitters can be programmed using a diagnostic tool or by using the ignition lock cylinder method.

Global Open/Close

⚠ WARNING: Disconnect the battery ground cable when working on or near the driver side door cylinder lock rod or door latch. Failure to follow these instructions may result in personal injury.

The global open/close feature is controlled by the DDM. The global open feature involves the DDM either receiving a signal from the door lock cylinder being held in the UNLOCK position for two seconds or the DDM receives a signal from a remote transmitter (when the customer holds the UNLOCK button on the

transmitter for two seconds to activate the feature) and sends a voltage signal to the LH front, RH front smart window motors and the smart roof opening panel motor (if equipped). The smart window motors and smart roof opening panel motor will carry out a global open (simultaneous opening of the front windows and roof opening panel). Pressing any button on the remote transmitter, or actuating the door lock cylinder to the UNLOCK or LOCK position will interrupt the global open function. The global close feature can only be accomplished with the key in the door lock cylinder. The key must hold the door lock cylinder to the LOCK position for two seconds, at which time the DDM will receive the door lock cylinder signal and send a global close signal to the smart window motors and the smart roof opening panel motor. The smart motors will then carry out a global close (simultaneous closing of the front windows and roof opening panel) function. The global close function can be terminated in the same manner as the global open function.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Door lock mechanisms	• Rear battery junction box (BJB) fuse(s): ♦ 1 (15A) ♦ 4 (10A) ♦ 23 (30A) ♦ 25 (40A) ♦ 27 (30A) • Central junction box (CJB) fuse(s): ♦ 7 (5A) ♦ 20 (10A) ♦ 22 (10A) • Driver door module (DDM) • Rear electronic module (REM) • Front electronic module (FEM) • Circuitry • Remote keyless entry (RKE) transmitter

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for DDM, refer to Section 419-10 .
   - No response/not equipped for REM, refer to Section 419-10 .
   - No response/not equipped for FEM, refer to Section 419-10 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out the self-test diagnostics for the DDM, FEM, or REM.

7. If the DTCs retrieved are related to the concern, go to Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index, the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index, the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index, or the Switched System Power (SSP) Relay Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1309	Power Door Lock Circuit Short to Ground	DDM	GO to Pinpoint Test C .
B1341	Power Door Unlock Circuit Short to Ground	DDM	GO to Pinpoint Test C .
B1526	Keyless Entry Circuit Short to Ground	DDM	GO to Pinpoint Test J .
B2112	Door Driver Set Switch Stuck Failure	DDM	GO to Pinpoint Test E .
B2116	Door Driver Reset Switch Stuck Failure	DDM	GO to Pinpoint Test E .
B2425	Remote Keyless Entry Out of Synchronization	DDM	GO to Pinpoint Test Q .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1551	Luggage Compartment Lid Release Circuit Failure	FEM	GO to Pinpoint Test A .

Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1300	Power Door Lock Switch Circuit Failure	REM	GO to Pinpoint Test D .
B1310	Power Door Unlock Switch Circuit Failure	REM	GO to Pinpoint Test D .

Switched System Power (SSP) Relay Index

Relay	Fuse	Controlled System(s)
SSP1	Rear BJB fuse 27 (30A)	• Driver door lock (FEM) • LH high beam headlamps (FEM) • Front parking, turn, and side marker lamps (FEM) • RH low beam headlamp • Driver power mirror • PATS
SSP4	Rear BJB fuse 23 (30A)	• LH rear parking and stoplamps (REM) • RH rear turn signals (REM) • RH front, RH rear, and LH rear door locks (REM) • License lamps • Luggage compartment lid actuator and remote switch • Fuel door release actuator and switch • Luggage compartment lamp

When diagnosing an SSP relay, check that all systems for that relay are inoperative. Refer to Section 417-01 if:

- all systems for one SSP relay are inoperative.
- all systems for all SSP relays are inoperative.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Luggage Compartment Lid Is Inoperative — From The Remote Switch

Normal Operation

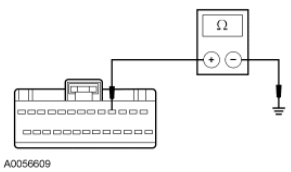
The luggage compartment lid remote switch supplies a ground signal, by connecting circuit 8-AA30 (WH) to circuit 31-AA30 (BK/YE), to the front electronic module (FEM). When the FEM receives the ground signal through circuit 8-AA30 (WH), the FEM sends a standard corporate protocol (SCP) message to the rear electronic module (REM), which energizes circuit 29S-AA83 (OG) and releases the luggage compartment lid.

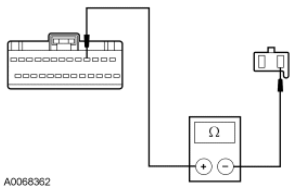
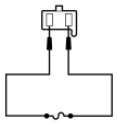
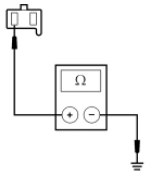
Possible Causes

- circuit 8-AA30 (WH) open or short to ground
- circuit 31-AA30 (BK/YE) open
- circuit 31-DA3 (BK/OG) open
- luggage compartment lid remote switch
- FEM

PINPOINT TEST A: THE LUGGAGE COMPARTMENT LID IS INOPERATIVE — FROM THE REMOTE SWITCH

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
A1 CHECK THE LUGGAGE COMPARTMENT LID REMOTE SWITCH INPUT TO THE FEM	
NOTE: Cycle the ignition switch from OFF to ON to enable the switched system power feature. • Ignition OFF. • Unlock the luggage compartment release switch with the valet key. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: FEM Luggage Compartment Lid Remote Switch PID. • Press and release the luggage compartment lid remote switch while monitoring the FEM luggage compartment lid remote switch PID. • **Does the FEM luggage compartment lid remote switch PID agree with the luggage compartment lid remote switch position?**	**Yes** GO to A7 . **No** If the FEM luggage compartment lid remote switch PID indicates ON at all times, GO to A2 . If the PID indicates OFF at all times, GO to A4 .
A2 CHECK THE LUGGAGE COMPARTMENT LID REMOTE SWITCH	
• Enter the following diagnostic mode on the scan tool: Monitor the FEM Luggage Compartment Lid Remote Switch PID. • Disconnect: Luggage Compartment Lid Remote Switch C207. • **Does the FEM luggage compartment lid remote switch PID change from ON to OFF?**	**Yes** INSTALL a new luggage compartment lid remote switch. CLEAR the DTCs. REPEAT the self-test. **No** GO to A3 .
A3 CHECK CIRCUIT 8-AA30 (WH) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: FEM C201e. • Measure the resistance between the FEM C201e-4, circuit 8-AA30 (WH), harness side and ground.  A0056609 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A7 . **No** GO to A4 .
A4 CHECK CIRCUIT 8-AA30 (WH) FOR AN OPEN	

• Disconnect: FEM C201e. • Disconnect: Luggage Compartment Lid Remote Switch C207. • Measure the resistance between the FEM C201e-4, circuit 8-AA30 (WH), harness side and the luggage compartment lid remote switch C207-1, circuit 8-AA30 (WH), harness side.  A0068362 • **Is the resistance less than 5 ohms?**	**Yes** CONNECT all the connectors and GO to A5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A5 CHECK THE LUGGAGE COMPARTMENT LID REMOTE SWITCH	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: FEM Luggage Compartment Lid Remote Switch PID. • Connect a fused (10A) jumper wire between the luggage compartment lid remote switch C207-2, circuit 31-AA30 (BK/YE), harness side and the luggage compartment lid remote switch C207-1, circuit 8-AA30 (WH), harness side while monitoring the FEM luggage compartment lid remote switch PID.  A0068363 • **Does the FEM luggage compartment lid remote switch PID change from OFF to ON?**	**Yes** INSTALL a new luggage compartment lid remote switch. CLEAR the DTCs. REPEAT the self-test. **No** GO to A6 .
A6 CHECK CIRCUIT 31-AA30 (BK/YE) FOR AN OPEN	
• Measure the resistance between the luggage compartment lid remote switch C207-2, circuit 31-AA30 (BK/YE), harness side and ground.  A0068364 • **Is the resistance less than 5 ohms?**	**Yes** GO to A7 . **No** REPAIR the circuit 31-AA30 (BK/YE) or circuit 31-DA3 (BK/OG). CLEAR the DTCs. REPEAT the self-test.
A7 CHECK FOR CORRECT FEM OPERATION	
• Disconnect all the FEM connectors.	**Yes** INSTALL a new FEM.

• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	REFER to Section 419-10 . REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Luggage Compartment Lid Is Inoperative — From The Remote Switch And The Remote Keyless Entry (RKE) Transmitter

Normal Operation

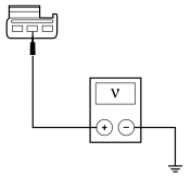
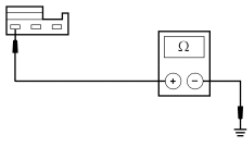
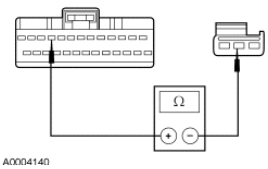
The luggage compartment lid remote switch supplies a ground signal to the front electronic module (FEM). When the FEM receives ground through circuit 8-AA30 (WH), the FEM sends a standard corporate protocol (SCP) message to the rear electronic module (REM), which energizes circuit 29S-AA83 (OG) and releases the luggage compartment lid. When the driver door module (DDM) receives the signal to open the luggage compartment lid from the RKE transmitter, the DDM sends an SCP message to the REM, which energizes circuit 29S-AA83 (OG) and releases the luggage compartment lid.

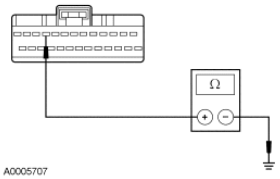
Possible Causes
- circuit 29S-AA83 (OG) short to ground or open
- circuit 31-AA83 (BK/OG) open
- luggage compartment lid actuator (part of the luggage compartment lid latch)
- REM

PINPOINT TEST B: THE LUGGAGE COMPARTMENT LID IS INOPERATIVE — FROM THE REMOTE SWITCH AND THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
B1 CHECK THE REM OUTPUT USING ACTIVE COMMANDS	
• Enter the following diagnostic mode on the scan tool: REM Active Command. • Trigger the REM active command RELEASE ON. • **Does the luggage compartment lid release?**	**Yes** GO to B6 . **No** GO to B2 .
B2 CHECK THE LUGGAGE COMPARTMENT LID REMOTE SWITCH OUTPUT FROM THE REM	

• Disconnect: Luggage Compartment Lid Actuator C430. • Enter the following diagnostic mode on the scan tool: ACTIVE COMMAND. • Trigger the REM Luggage Compartment Lid Release Active Command ON. • Measure the voltage between the luggage compartment lid actuator C430-2, circuit 29S-AA83 (OG), harness side and ground.  A0004138 • **Is the voltage greater than 10 volts?**	**Yes** GO to B3 . **No** GO to B4 .
B3 CHECK CIRCUIT 31-AA83 (BK/OG) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the luggage compartment lid actuator C430-3, circuit 31-AA83 (BK/OG), harness side and ground.  A0056653 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new luggage compartment lid actuator. REFER to Luggage Compartment Lid Latch in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B4 CHECK CIRCUIT 29S-AA83 (OG) FOR AN OPEN	
• Ignition OFF. • Disconnect: REM C420c. • Measure the resistance between the REM C420c-10, circuit 29S-AA83 (OG), harness side and the luggage compartment lid actuator C430-2, circuit 29S-AA83 (OG), harness side.  A0004140 • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK CIRCUIT 29S-AA83 (OG) FOR A SHORT TO GROUND	
• Measure the resistance between the REM C420c-10, circuit 29S-AA83 (OG), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B6 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: All Door Locks Are Inoperative — From The Driver Door Lock Control Switch

Normal Operation

The driver door lock control switch supplies a ground signal, by connecting circuit 8-AA10 (WH/BK) to circuit 31-LH28 (BK) or circuit 8-AA11 (WH/VT) to circuit 31-LH28 (BK), to the driver door module (DDM). When the DDM receives ground through circuit 8-AA10 (WH/BK), the DDM sends a message through the standard corporate protocol (SCP) network to the rear electronic module (REM), which locks the passenger doors. At the same time the DDM locks the driver door. When the DDM receives ground through circuit 8-AA11 (WH/VT), the DDM sends a message through the SCP network to the REM, which unlocks the passenger doors at the same time the DDM unlocks the driver door.

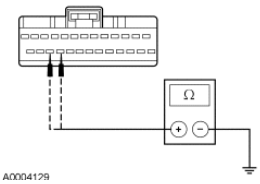
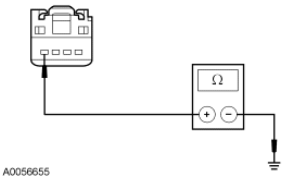
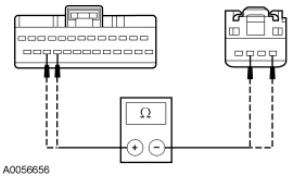
Possible Causes

- circuit 8-AA10 (WH/BK) short to ground or open
- circuit 8-AA11 (WH/VT) short to ground or open
- circuit 31-LH28 (BK) open
- driver door lock control switch
- DDM

PINPOINT TEST C: ALL DOOR LOCKS ARE INOPERATIVE — FROM THE DRIVER DOOR LOCK CONTROL SWITCH

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
C1 RETRIEVE THE RECORDED DDM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded DDM DTCs from the continuous and on-demand self-tests. • **Are any DDM DTCs recorded?**	**Yes** If DTC B1309 or DTC B1341 is retrieved, GO to C3 . For all other DDM DTCs, REFER to the Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index. **No** GO to C2 .
C2 CHECK THE DRIVER DOOR LOCK CONTROL SWITCH AND CIRCUITS — MONITOR THE DDM DOOR LOCK AND DOOR UNLOCK PIDS	
NOTE: Cycle the key from OFF to ON to enable the switched system power feature. • Ignition OFF. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DDM PID. • Monitor the DDM door lock and door unlock PIDs. • Lock and unlock the driver door using the driver door lock control switch while monitoring the DDM door lock and door unlock PIDs. • **Do the DDM door lock and door unlock PID values agree with the driver door lock control switch positions?**	**Yes** GO to C8 . **No** If the PID(s) reads YES at all times, GO to C3 . If the PID(s) reads NO at all times, GO to C5 .
C3 CHECK THE DRIVER DOOR LOCK CONTROL SWITCH	
• Ignition OFF. • Disconnect: Driver Door Lock Control Switch C505. • Carry out the driver door lock control switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the driver door lock control switch OK?**	**Yes** GO to C4 . **No** INSTALL a new driver door lock control switch. REFER to Door Lock Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.
C4 CHECK CIRCUITS 8-AA10 (WH/BK) AND 8-AA11 (WH/VT) FOR A SHORT TO GROUND	
• Disconnect: DDM C501d. • Measure the resistance between the DDM C501d-23, circuit 8-AA10 (WH/BK), harness side and ground; and between the DDM C501d-24, circuit 8-AA11 (WH/VT), harness side and ground.	**Yes** GO to C8 . **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the

 A0004129 • **Are the resistances greater than 10,000 ohms?**	self-test.
C5 CHECK THE DRIVER DOOR LOCK CONTROL SWITCH	
• Ignition OFF. • Disconnect: Driver Door Lock Control Switch C505. • Carry out the driver door lock control switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the driver door lock control switch OK?**	**Yes** GO to C6 . **No** INSTALL a new driver door lock control switch. REFER to Door Lock Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.
C6 CHECK CIRCUIT 31-LH28 (BK) FOR AN OPEN	
• Measure the resistance between the driver door lock control switch C505-4, circuit 31-LH28 (BK), harness side and ground.  A0056655 • **Is the resistance less than 5 ohms?**	**Yes** GO to C7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C7 CHECK CIRCUITS 8-AA10 (WH/BK) AND 8-AA11 (WH/VT) FOR AN OPEN	
• Disconnect: DDM C501d. • Measure the resistance between the DDM C501d-23, circuit 8-AA10 (WH/BK), harness side and the driver door lock control switch C505-1, circuit 8-AA10 (WH/BK), harness side; and between the DDM C501d-24, circuit 8-AA11 (WH/VT), harness side and the driver door lock control switch C505-3, circuit 8-AA11 (WH/VT), harness side.  A0056656	**Yes** GO to C8 . **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

• **Are the resistances less than 5 ohms?**	
C8 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote keyless entry (RKE) transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: All Door Locks Are Inoperative — From The Passenger Door Lock Control Switch

Normal Operation

The passenger door lock control switch supplies a ground signal, by connecting circuit 8-AA20 (WH/BU) to circuit 31-LH42 (BK) or circuit 8-AA21 (WH/GN) to circuit 31-LH42 (BK), to the rear electronic module (REM). When the REM receives ground through circuit 8-AA20 (WH/BU), the REM locks the passenger doors and sends a standard corporate protocol (SCP) message to the driver door module (DDM) to lock the driver door. When the REM receives ground through circuit 8-AA21 (WH/GN), the REM unlocks the passenger doors and sends an SCP message to the DDM to unlock the driver door.

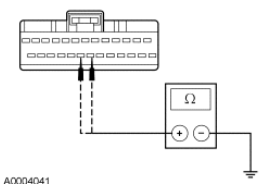
Possible Causes

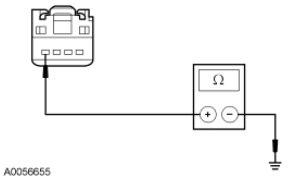
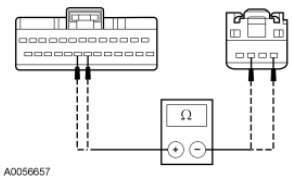
- circuit 8-AA20 (WH/BU) open or short to ground
- circuit 8-AA21 (WH/GN) open or short to ground
- circuit 31-LH42 (BK) open
- passenger door lock control switch
- REM

PINPOINT TEST D: ALL DOOR LOCKS ARE INOPERATIVE — FROM THE PASSENGER DOOR LOCK CONTROL SWITCH

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
D1 RETRIEVE THE RECORDED REM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded REM DTCs from the continuous and on-demand self-tests. • **Are any REM DTCs recorded?**	**Yes** For DTC B1300 or B1310, GO to D3 . For all other REM DTCs,

	REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index. **No** GO to D2 .
D2 CHECK THE PASSENGER DOOR LOCK CONTROL SWITCH AND CIRCUITS — MONITOR THE REM RH FRONT DOOR LOCK AND UNLOCK PIDS	
NOTE: Cycle the ignition switch from OFF to ON to enable the switched system power feature. • Ignition OFF. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: REM PID. • Monitor the REM RH front door lock and unlock PIDs. • Lock and unlock the RH front door using the passenger door lock control switch while monitoring the REM RH front door lock and unlock PIDs. • **Do the REM RH front door lock and unlock PID values agree with the passenger door lock control switch positions?**	**Yes** GO to D8 . **No** If the PID(s) reads YES at all times, GO to D3 . If the PID(s) reads NO at all times, GO to D5 .
D3 CHECK THE PASSENGER DOOR LOCK CONTROL SWITCH	
• Ignition OFF. • Disconnect: Passenger Door Lock Control Switch C605. • Carry out the passenger door lock control switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the passenger door lock control switch OK?**	**Yes** GO to D4 . **No** INSTALL a new passenger door lock control switch. REFER to Door Lock Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK CIRCUITS 8-AA20 (WH/BU) AND 8-AA21 (WH/GN) FOR A SHORT TO GROUND	
• Disconnect: REM C420c. • Measure the resistance between the REM C420c-20, circuit 8-AA20 (WH/BU), harness side and ground; and between the REM C420c-21, circuit 8-AA21 (WH/GN), harness side and ground.  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to D8 . **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

D5 CHECK THE PASSENGER DOOR LOCK CONTROL SWITCH	
• Ignition OFF. • Disconnect: Passenger Door Lock Control Switch C605. • Carry out the passenger door lock control switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the passenger door lock control switch OK?**	**Yes** GO to D6 . **No** INSTALL a new passenger door lock control switch. REFER to Door Lock Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.
D6 CHECK CIRCUIT 31-LH42 (BK) FOR AN OPEN	
• Measure the resistance between the passenger door lock control switch C605-4, circuit 31-LH42 (BK), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to D7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D7 CHECK CIRCUITS 8-AA20 (WH/BU) AND 8-AA21 (WH/GN) FOR AN OPEN	
• Disconnect: REM C420c. • Measure the resistance between the REM C420c-20, circuit 8-AA20 (WH/BU), harness side and the passenger door lock control switch C605-1, circuit 8-AA20 (WH/BU), harness side; and between the REM C420c-21, circuit 8-AA21 (WH/GN), harness side and the passenger door lock control switch C605-3, circuit 8-AA21 (WH/GN), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to D8 . **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.
D8 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
	Yes
	INSTALL a new REM. REFER to Section 419-10 . REPEAT the self-test.
	
	No
	The system is operating

• **Is the concern still present?**	correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: All Door Locks Are Inoperative — From The Driver Door Lock Cylinder

Normal Operation

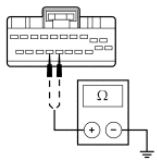
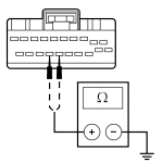
When the driver door lock cylinder is turned once to either the lock or the unlock position, the driver set/reset switch grounds either circuit 31S-AA78 (BK/BU) for the lock command or circuit 31S-AA79 (BK/WH) for the unlock command through circuit 31-AA58 (BK) to the driver door module (DDM). The DDM locks and unlocks the driver door. When a global lock/unlock command is requested through the driver door lock cylinder, the driver set/reset switch grounds either circuit 31S-AA78 (BK/BU) for the lock command or circuit 31S-AA79 (BK/WH) for the unlock command through circuit 31-AA58 (BK) to the driver door module (DDM). The DDM locks or unlocks the driver door and sends a standard corporate protocol (SCP) message to the rear electronic module (REM) to lock/unlock the passenger doors.

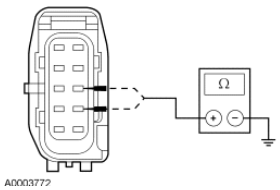
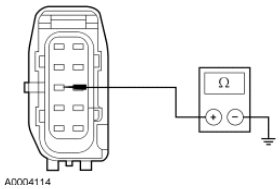
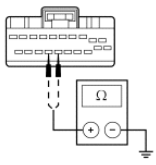
Possible Causes
- circuit 31-AA58 (BK) open
- circuit 31S-AA78 (BK/BU) open or short to ground
- circuit 31S-AA79 (BK/WH) open or short to ground
- driver door latch (driver set/reset switch)
- DDM

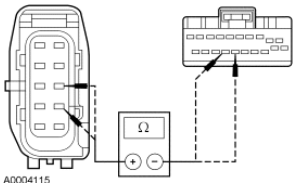
PINPOINT TEST E: ALL DOOR LOCKS ARE INOPERATIVE — FROM THE DRIVER DOOR LOCK CYLINDER

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
E1 RETRIEVE THE RECORDED DDM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded DDM DTCs from the continuous and on-demand self-tests. • **Are any DDM DTCs recorded?**	**Yes** For DTC B2112 or DTC B2116, GO to E3 . For all other DDM DTCs, REFER to the Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index. **No** GO to E2 .
E2 CHECK THE DRIVER DOOR LOCK CYLINDER AND CIRCUITS — MONITOR THE DDM LOCK CYLINDER INPUT SWITCH STATUS AND DOOR UNLOCK DISARM INPUT SWITCH STATUS PIDS	

NOTE: Cycle the ignition switch from the OFF to the ON position to enable the switched system power feature. • Ignition OFF. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DDM PID. • Monitor the DDM lock cylinder input switch status and door unlock disarm input switch status PIDs. • Lock and unlock the driver door using the driver door lock cylinder while monitoring the DDM lock cylinder input switch status and door unlock disarm input switch status PIDs. • **Do the DDM lock cylinder input switch status and door unlock disarm input switch status PID values agree with the driver door lock cylinder positions?**	**Yes** GO to E9 . **No** GO to E3 .
E3 CHECK CIRCUITS 31S-AA78 (BK/BU) AND 31S-AA79 (BK/WH) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: DDM C501c. • Measure the resistance between the DDM C501c-16, circuit 31S-AA78 (BK/BU), harness side and ground; and between the DDM C501c-17, circuit 31S-AA79 (BK/WH), harness side and ground.  A0003773 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to E5 . **No** GO to E4 .
E4 CHECK THE DRIVER DOOR LOCK LATCH FOR A SHORT TO GROUND	
• Disconnect: Driver Door Latch C525. • Measure the resistance between the DDM C501c-16, circuit 31S-AA78 (BK/BU), harness side and ground; and between the DDM C501c-17, circuit 31S-AA79 (BK/WH), harness side and ground.  A0003773 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver door latch. REFER to Front Door Latch in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.
E5 CHECK THE DDM FOR AN INTERNAL SHORT TO GROUND	

• Connect: DDM C501c. • Disconnect: Driver Door Latch C525. • Measure the resistance between the driver door latch C525-7, circuit 31S-AA78 (BK/BU), harness side and ground; and between the driver door latch C525-5, circuit 31S-AA79 (BK/WH), harness side and ground.  A0003772 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to E6 . **No** GO to E9 .
E6 CHECK CIRCUIT 31-AA58 (BK) FOR AN OPEN	
• Measure the resistance between the driver door latch C525-6, circuit 31-AA58 (BK), harness side and ground.  A0004114 • **Is the resistance less than 5 ohms?**	**Yes** GO to E7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E7 CHECK THE DRIVER SET AND RESET SWITCH	
• Connect: Driver Door Latch C525. • Disconnect: DDM C501c. • Measure the resistance between the DDM C501c-16, circuit 31S-AA78 (BK/BU), harness side and ground while turning the key cylinder to the SET position; and between the DDM C501c-17, circuit 31S-AA79 (BK/WH), harness side and ground while turning the key cylinder to the RESET position.  A0003773 • **Are the resistances less than 5 ohms?**	**Yes** GO to E9 . **No** GO to E8 .
E8 CHECK CIRCUITS 31S-AA78 (BK/BU) AND 31S-AA79 (BK/WH) FOR AN OPEN	

• Disconnect: Driver Door Latch C525. • Measure the resistance between the DDM C501c-16, circuit 31S-AA78 (BK/BU), harness side and the driver door latch C525-7, circuit 31S-AA78 (BK/BU), harness side; and between the DDM C501c-17, circuit 31S-AA79 (BK/WH), harness side and the driver door latch C525-5, circuit 31S-AA79 (BK/WH), harness side.  A0004115 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new driver door latch. REFER to Front Door Latch in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.
E9 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote keyless entry (RKE) transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: A Single Door Lock Is Inoperative — Driver Door

Normal Operation

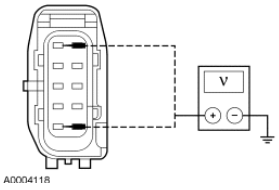
The driver door module (DDM) receives lock/unlock inputs from the driver door lock control switch, passenger door lock control switch (through the rear electronic module [REM]), remote keyless entry (RKE) transmitter, or keyless entry keypad. The DDM then locks/unlocks the driver door through circuit 33-AA10 (YE/BK) and circuit 32-AA11 (WH/VT).

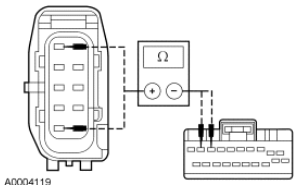
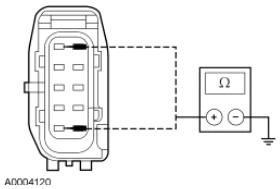
Possible Causes

- circuit 32-AA11 (WH/VT) short to ground or open
- circuit 33-AA10 (YE/BK) short to ground or open
- driver door latch
- DDM

PINPOINT TEST F: A SINGLE DOOR LOCK IS INOPERATIVE — DRIVER DOOR

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
F1 CHECK THE DRIVER DOOR LOCK OPERATION USING ACTIVE COMMANDS	
NOTE: Cycle the key from OFF to ON to enable the switched system power feature. • Ignition OFF. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: ACTIVE COMMAND. • Trigger the DDM driver door lock and driver door unlock active commands on and off. • **Do the DDM driver door lock and driver door unlock active commands operate correctly?**	**Yes** GO to F5 . **No** GO to F2 .
F2 CHECK THE DDM LOCK AND UNLOCK OUTPUTS USING THE ACTIVE COMMANDS	
• Ignition OFF. • Disconnect: Driver Door Latch C525. • Ignition ON. • Measure the voltage between the driver door latch C525-2, circuit 33-AA10 (YE/BK), harness side and ground while triggering the DDM driver door lock active command to ON; and measure the voltage between the driver door latch C525-10, circuit 32-AA11 (WH/VT), harness side and ground while triggering the DDM driver door unlock active command to ON.  A0004118 • **Are the voltages greater than 10 volts?**	**Yes** INSTALL a new driver door latch. REFER to Front Door Latch in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to F3 .
F3 CHECK CIRCUITS 32-AA11 (WH/VT) AND 33-AA10 (YE/BK) FOR AN OPEN	
• Ignition OFF. • Disconnect: DDM C501c. • Measure the resistance between the driver door latch C525-2, circuit 33-AA10 (YE/BK), harness side and the DDM C501c-8, circuit 33-AA10 (YE/BK), harness side; and between the driver door latch C525-10, circuit 32-AA11 (WH/VT), harness side and the DDM	**Yes** GO to F4 . **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

C501c-9, circuit 32-AA11 (WH/VT), harness side.  A0004119 • **Are the resistances less than 5 ohms?**	
F4 CHECK CIRCUITS 32-AA11 (WH/VT) AND 33-AA10 (YE/BK) FOR A SHORT TO GROUND	
• Measure the resistance between the driver door latch C525-2, circuit 33-AA10 (YE/BK), harness side and ground; and between the driver door latch C525-10, circuit 32-AA11 (WH/VT), harness side and ground.  A0004120 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to F5 . **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.
F5 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote keyless entry (RKE) transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: More Than One Door Lock Is Inoperative — RH Front Door, RH Rear Door, and LH Rear Door

Normal Operation

The driver door module (DDM) receives lock/unlock inputs from the driver door lock control switch, remote keyless entry (RKE) transmitter, or keyless entry keypad. The DDM sends a standard corporate protocol (SCP) message to the rear electronic module (REM) for the lock/unlock function.

The REM receives lock/unlock input from the DDM and the passenger door lock control switch. The REM then locks/unlocks the passenger doors through circuit 32-AA1 (WH/RD), circuit 32-AA16 (WH/BK), circuit 33-AA2 (YE/RD), and circuit 33-AA15 (YE/GN). The REM is energized through circuit 29S-DK31 (OG/BK) and grounded through circuit 31-DK30 (BK/OG).

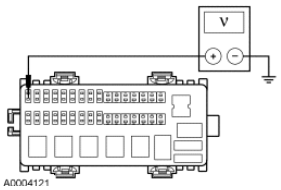
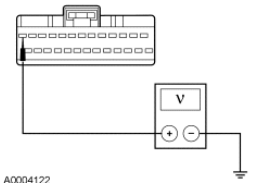
Possible Causes

- fuse
- circuit 29S-DK31 (OG/BK) short to ground or open
- circuit 31-DK30 (BK/OG) open
- circuit 32-AA1 (WH/RD) short to ground or open
- circuit 32-AA16 (WH/BK) short to ground or open
- circuit 33-AA2 (YE/RD) short to ground or open
- circuit 33-AA15 (YE/GN) short to ground or open
- battery junction box (BJB)
- REM

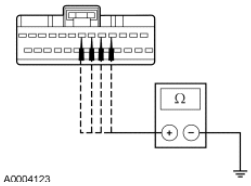
PINPOINT TEST G: MORE THAN ONE DOOR LOCK IS INOPERATIVE — RH FRONT DOOR, RH REAR DOOR, AND LH REAR DOOR

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

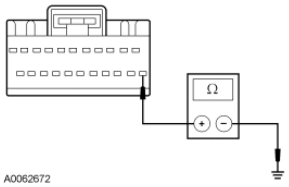
Test Step	Result / Action to Take
G1 RETRIEVE THE RECORDED REM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded REM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index. **No** GO to G2 .
G2 CHECK BATTERY JUNCTION BOX (BJB) FUSE 1 (15A) FOR VOLTAGE	
NOTE: Cycle the ignition switch from the OFF to the ON position to enable the switched system power feature. • Disconnect: BJB fuse 1 (15A). • Measure the voltage between the BJB fuse 1 (15A) input cavity, component side and ground.	**Yes** CONNECT the BJB fuse 1 (15A). GO to G3 . **No** REPAIR the BJB. TEST the system for normal operation.

 A0004121 • **Is the voltage greater than 10 volts?**	
G3 CHECK CIRCUIT 29S-DK31 (OG/BK) FOR AN OPEN	
• Ignition OFF. • Disconnect: REM C420c. • Ignition ON. • Measure the voltage between the REM C420c-13, circuit 29S-DK31 (OG/BK), harness side and ground.  A0004122 • **Is the voltage greater than 10 volts?**	**Yes** GO to G4 . **No** REPAIR circuit 29S-DK31 (OG/BK). TEST the system for normal operation.
G4 CHECK THE REM OUTPUT USING THE ACTIVE COMMANDS	
• Ignition OFF. • Connect: REM C420c. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Active Commands. • Trigger the REM LH rear lock, RH rear lock, RH rear unlock, and LH rear unlock active commands ON and OFF while observing the RH rear and LH rear latches. • **Do the RH rear and the LH rear latches operate correctly?**	**Yes** GO to G6 . **No** If a single latch does not operate, GO to Symptom Chart . If both latches do not operate, GO to G5 .
G5 CHECK CIRCUITS 32-AA1 (WH/RD), 33-AA2 (YE/RD), 33-AA15 (YE/GN), AND 32-AA16 (WH/BK) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: REM C420c. • Measure the resistance between the REM connector, harness side and ground as follows: **Connector-Pin** / **Circuit** C420c-4 / 33-AA15 (YE/GN)	**Yes** GO to G6 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

C420c-5	33-AA2 (YE/RD)
C420c-6	32-AA1 (WH/RD)
C420c-7	32-AA16 (WH/BK)



- **Are the resistances greater than 10,000 ohms?**

G6 CHECK CIRCUIT 31-DK30H (BK/OG) FOR AN OPEN	
• Disconnect: REM C420b. • Measure the resistance between the REM C420b-12, circuit 31-DK30H (BK/OG), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to G7 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
G7 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: More Than One Door Lock Is Inoperative — RH Front Door and RH Rear Door

Normal Operation

The driver door module (DDM) receives lock/unlock inputs from the driver door lock control switch, remote keyless entry (RKE) transmitter, or keyless entry keypad. The DDM sends an standard corporate protocol (SCP) message to the rear electronic module (REM) for the lock/unlock function.

The REM receives lock/unlock input from the DDM and the passenger door lock control switch. The REM then locks/unlocks the RH front door and RH rear door through circuit 32-AA1 (WH/RD), circuit 33-AA25 (YE/RD), circuit 33-AA2 (YE/RD), circuit 32-AA21 (WH/GN), circuit 33-AA20 (YE/BU), and circuit

32-AA26 (WH/BU).

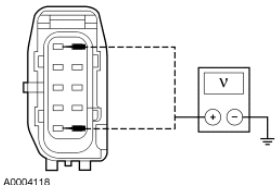
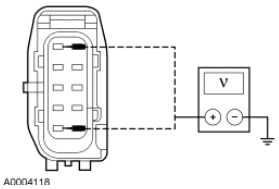
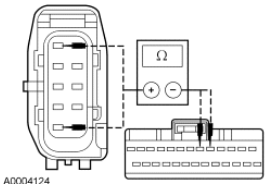
Possible Causes

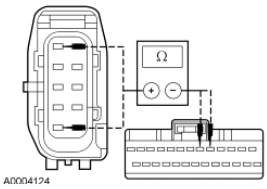
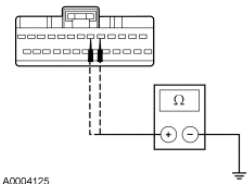
- circuit 32-AA1 (WH/RD) short to ground or open
- circuit 32-AA21 (WH/GN) short to ground or open
- circuit 32-AA26 (WH/BU) short to ground or open
- circuit 33-AA2 (YE/RD) short to ground or open
- circuit 33-AA20 (YE/BU) short to ground or open
- circuit 33-AA25 (YE/RD) short to ground or open
- door latch (front or rear)
- REM

PINPOINT TEST H: MORE THAN ONE DOOR LOCK IS INOPERATIVE — RH FRONT DOOR AND RH REAR DOOR

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
H1 RETRIEVE THE RECORDED REM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded REM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index. **No** GO to H2 .
H2 CHECK THE REM OUTPUT USING THE ACTIVE COMMANDS	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: ACTIVE COMMAND. • Trigger the REM RH rear lock and RH rear unlock active commands ON and OFF while observing the RH front and RH rear lock function. • **Do the REM RH rear lock and RH rear unlock active commands operate correctly?**	**Yes** GO to H6 . **No** GO to H3 .
H3 CHECK THE REM OUTPUT TO THE RH FRONT AND THE RH REAR LATCHES	
NOTE: Disconnect the inoperative door latch. If both doors are inoperative, disconnect both latches. • Ignition OFF. • Disconnect: RH Rear Door Latch C804. • Disconnect: RH Front Door Latch C609. • Ignition ON. • Measure the voltage between the RH front door latch C609-2, circuit 33-AA20 (YE/BU), harness side and ground while	**Yes** INSTALL a new door latch(es). REFER to Front Door Latch or Rear Door Latch in this section. TEST the system for normal operation. **No** GO to H4 .

triggering the REM RH front door lock active command to ON; and measure the voltage between the RH front door latch C609-10, circuit 32-AA21 (WH/GN), harness side and ground while triggering the REM RH front door unlock active command to ON.  A0004118 • Measure the voltage between the RH rear door latch C804-2, circuit 33-AA25 (YE/RD), harness side and ground while triggering the REM RH rear door lock active command to ON; and measure the voltage between RH rear door latch C804-10, circuit 32-AA26 (WH/BU), harness side and ground while triggering the REM RH rear door unlock active command to ON.  A0004118 • **Are the voltages greater than 10 volts?**	
H4 CHECK CIRCUITS 32-AA1 (WH/RD), 32-AA21 (WH/GN), 32-AA26 (WH/BU), 33-AA2 (YE/RD), 33-AA20 (YE/BU), AND 33-AA25 (YE/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: REM C420c. • Measure the resistance between the RH front door latch C609-2, circuit 33-AA20 (YE/BU), harness side and the REM C420c-5, circuit 33-AA2 (YE/RD), harness side; and between the RH front door latch C609-10, circuit 32-AA21 (WH/GN), harness side and the REM C420c-6, circuit 32-AA1 (WH/RD), harness side.  A0004124 • Measure the resistance between the RH rear door latch C804-2, circuit 33-AA25 (YE/RD), harness side and the REM C420c-5, circuit 33-AA2 (YE/RD), harness side; and between the RH rear door lock latch C804-10, circuit 32-AA26 (WH/BU), harness	**Yes** GO to H5 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

side and the REM C420c-6, circuit 32-AA1 (WH/RD), harness side.  A0004124 • **Are the resistances less than 5 ohms?**	
H5 CHECK CIRCUITS 33-AA2 (YE/RD) AND 32-AA1 (WH/RD) FOR A SHORT TO GROUND	
• Measure the resistance between the REM C420c-5, circuit 33-AA2 (YE/RD), harness side and ground; and between the REM C420c-6, circuit 32-AA1 (WH/RD), harness side and ground.  A0004125 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to H6 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
H6 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: A Single Door Lock Is Inoperative — LH Rear Door

Normal Operation

The driver door module (DDM) receives lock/unlock inputs from the driver door lock control switch, remote keyless entry (RKE) transmitter, or keyless entry keypad. The DDM sends a standard corporate protocol (SCP) message to the rear electronic module (REM) for the lock/unlock function.

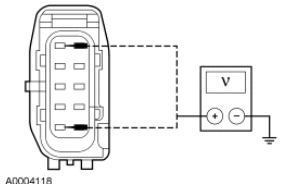
The REM receives lock/unlock input from the DDM and the passenger door lock control switch. The REM then locks/unlocks the LH rear door through circuit 32-AA16 (WH/BK) and circuit 33-AA15 (YE/GN).

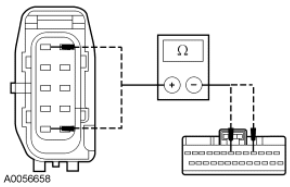
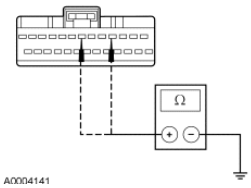
Possible Causes

- circuit 32-AA16 (WH/BK) short to ground or open
- circuit 33-AA15 (YE/GN) short to ground or open
- rear door latch
- REM

PINPOINT TEST I: A SINGLE DOOR LOCK IS INOPERATIVE — LH REAR DOOR

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
I1 RETRIEVE THE RECORDED REM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded REM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index. **No** GO to I2 .
I2 CHECK THE REM OUTPUT USING THE ACTIVE COMMANDS	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: ACTIVE COMMAND. • Trigger the REM LH rear lock and LH rear unlock active commands ON and OFF while observing the LH rear lock function. • **Does the LH rear lock operate correctly?**	**Yes** GO to I6 . **No** GO to I3 .
I3 CHECK THE REM OUTPUT TO THE LH REAR LATCH	
• Ignition OFF. • Disconnect: LH Rear Door Latch C704. • Ignition ON. • Measure the voltage between the LH rear door latch C704-2, circuit 33-AA15 (YE/GN), harness side and ground while triggering the REM LH rear door lock active command to ON; and measure the voltage between the LH rear door latch C704-10, circuit 32-AA16 (WH/BK), harness side and ground while triggering the REM LH rear door unlock active command to ON.  A0004118	**Yes** INSTALL a new rear door latch. REFER to Rear Door Latch in this section. TEST the system for normal operation. **No** GO to I4 .

• **Are the voltages greater than 10 volts?**	
I4 CHECK CIRCUITS 32-AA16 (WH/BK) AND 33-AA15 (YE/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: REM C420c. • Measure the resistance between the LH rear door latch C704-2, circuit 33-AA15 (YE/GN), harness side and the REM C420c-4, circuit 33-AA15 (YE/GN), harness side; and between the LH rear door latch C704-10, circuit 32-AA16 (WH/BK), harness side and the REM C420c-7, circuit 32-AA16 (WH/BK), harness side.  A0056658 • **Are the resistances less than 5 ohms?**	**Yes** GO to I5 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
I5 CHECK CIRCUITS 32-AA16 (WH/BK) AND 33-AA15 (YE/GN) FOR A SHORT TO GROUND	
• Measure the resistance between the REM C420c-4, circuit 33-AA15 (YE/GN), harness side and ground; and between the REM C420c-7, circuit 32-AA16 (WH/BK), harness side and ground.  A0004141 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to I6 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
I6 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: The Doors Do Not Lock/Unlock Using The Remote Keyless Entry Keypad

Normal Operation

When the customer code buttons are pressed on the keyless entry keypad, a signal is sent on circuits 7-AA70 (YE/GN), 8-AA70 (WH/GN), and 10-AA70 (GY/OG) by completing the selected circuit buttons to circuit 9-AA70 (BN/GN), to the driver door module (DDM) to activate the function requested. The customer code is entered to unlock the driver door. Entering the customer code and pressing the 3/4 button unlocks all the doors. Pressing 7/8 and 9/0 locks all the doors. No customer code is required to lock the doors using the keyless entry keypad.

If memory settings are programmed, customer code 1 is used to unlock the door and recall memory position 1. Customer Code 2 is used to unlock the door and recall memory position 2.

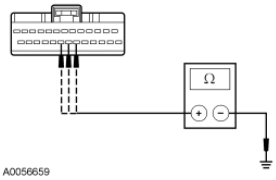
Possible Causes

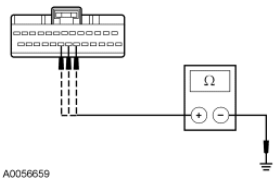
- circuit 7-AA70 (YE/GN) short to ground or open
- circuit 8-AA70 (WH/GN) short to ground or open
- circuit 9-AA70 (BN/GN) open
- circuit 10-AA70 (GY/OG) short to ground or open
- keyless entry keypad
- DDM

PINPOINT TEST J: THE DOORS DO NOT LOCK/UNLOCK USING THE REMOTE KEYLESS ENTRY KEYPAD

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
J1 CHECK THE LOCK/UNLOCK OPERATION FROM THE DRIVER DOOR LOCK CONTROL SWITCH	
• Lock and unlock all the doors using the driver door lock control switch and the keyless entry keypad. • Open the luggage compartment using the keyless entry keypad. • **Do all the doors lock and unlock correctly?**	**Yes** If the memory seat does not operate correctly using the keyless entry keypad, but all other functions operate correctly, GO to J2 . If one or more other functions do not operate correctly using the keyless entry keypad, GO to J3 . **No** GO to Symptom Chart to diagnose the inoperative function.
J2 CHECK THAT THE KEYLESS ENTRY KEYPAD IS ASSOCIATED WITH A MEMORY POSITION	
• Activate the keyless entry keypad memory recall feature. • Position the seat, mirrors, steering column, and adjustable pedals to the desired positions. • **Does the keyless entry keypad memory position recall operate correctly?**	**Yes** The system is operating correctly at this time. CLEAR the DTCs. REPEAT the self-test. **No** GO to J3 .

J3 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCs)	
• Check for recorded results from the DDM self-test. • **Is DTC B1526 recorded?**	**Yes** GO to J4 . **No** GO to J6 .
J4 CHECK THE KEYLESS ENTRY KEYPAD INPUT TO THE DDM FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: DDM C501d. • Measure the resistance between DDM C501d, harness side and ground as follows: **DDM Connector/Pin** / **Circuit** C501d-19 / 8-AA70 (WH/GN) C501d-20 / 10-AA70 (GY/OG) C501d-21 / 7-AA70 (YE/GN)  A0056659 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to J10 . **No** GO to J5 .
J5 CHECK THE KEYLESS ENTRY KEYPAD FOR A SHORT TO GROUND	
• Disconnect: Keyless Entry Keypad C500. • Measure the resistance between DDM C501d, harness side and ground as follows: **DDM Connector/Pin** / **Circuit** C501d-19 / 8-AA70 (WH/GN) C501d-20 / 10-AA70 (GY/OG) C501d-21 / 7-AA70 (YE/GN)	**Yes** INSTALL a new keyless entry keypad. REFER to Remote Keyless Entry Keypad in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.



- **Are the resistances greater than 10,000 ohms?**

J6 CHECK THE FACTORY KEYLESS CODE

- Enter the following diagnostic mode on the scan tool: DDM PID.
- Monitor the DDM Key Code PID.
- Record the code.
- **Does the recorded code match the code on the factory sticker or wallet card?**

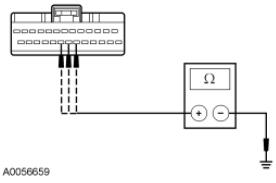
Yes
GO to J7 .

No
CHECK the operation of the factory code retrieved from the DDM. If OK, NOTIFY the customer of the correct code. If still inoperative, CLEAR the DTCs. REPEAT the self-test and GO to J7 .

J7 CHECK THE KEYLESS ENTRY KEYPAD OPERATION

- Ignition OFF.
- Disconnect: DDM C501d.
- Measure the resistance between DDM C501d, harness side and ground while pressing the associated keyless entry keypad button as follows:

DDM Connector/Pin	Circuit	Keyless Entry Keypad Buttons
C501d-19	8-AA70 (WH/GN)	1/2, 3/4, and 5/6
C501d-20	10-AA70 (GY/OG)	5/6 and 7/8
C501d-21	7-AA70 (YE/GN)	3/4 and 9/0

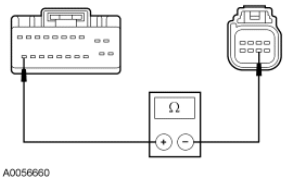


- **Are the resistances less than 5 ohms with the associated buttons pressed?**

Yes
GO to J10 .

No
GO to J8 .

J8 CHECK CIRCUIT 9-AA70 (BN/GN) FOR AN OPEN

<table>
<tr><td>
• Disconnect: DDM C501c.
• Disconnect: Keyless Entry Keypad C500.
• Measure the resistance between the keyless entry keypad C500-6, circuit 9-AA70 (BN/GN), harness side and the DDM C501c-20, circuit 9-AA70 (BN/GN), harness side.

A0056660
• Is the resistance less than 5 ohms?
</td><td>
Yes
GO to J9 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
</td></tr>
<tr><td>J9 CHECK THE KEYLESS ENTRY KEYPAD CIRCUITS FOR AN OPEN</td><td></td></tr>
<tr><td>
• Measure the resistance between DDM C501d, harness side and keyless entry keypad C500 as follows:
<table>
<tr><th>DDM Connector/Pin</th><th>Circuit</th><th>Keyless Entry Keypad Connector/Pin</th></tr>
<tr><td>C501d-19</td><td>8-AA70 (WH/GN)</td><td>C500-1</td></tr>
<tr><td>C501d-20</td><td>10-AA70 (GY/OG)</td><td>C500-3</td></tr>
<tr><td>C501d-21</td><td>7-AA70 (YE/GN)</td><td>C500-7</td></tr>
</table>
• Are the resistances less than 5 ohms?
</td><td>
Yes
INSTALL a new keyless entry keypad. REFER to Remote Keyless Entry Keypad in this section. CLEAR the DTCs. REPEAT the self-test

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
</td></tr>
<tr><td>J10 CHECK FOR CORRECT DDM OPERATION</td><td></td></tr>
<tr><td>
• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• Is the concern still present?
</td><td>
Yes
INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote keyless entry (RKE) transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. CLEAR the DTCs. REPEAT the self-test.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test
</td></tr>
</table>

Pinpoint Test K: The Doors Do Not Lock/Unlock Using The Remote Keyless Entry Transmitter

Normal Operation

Remote locking and unlocking of the doors is accomplished by the driver door module (DDM) receiving a command message from the remote keyless entry (RKE) transmitter. The DDM processes the command and sends a signal directly to the driver door latch. The DDM sends a message through the standard corporate protocol (SCP) network to the rear electronic module (REM), which activates the passenger door latches.

All RKE transmitters must be present to begin diagnosis of the RKE system.

Aftermarket or dealer-installed systems may adversely affect the RKE system operation. These systems should be disconnected before diagnosing any RKE concerns.

Possible Causes

- RKE transmitter battery
- RKE transmitter programming
- RKE transmitter
- aftermarket systems
- high power devices
- TV/radio transmission towers
- DDM

PINPOINT TEST K: THE DOORS DO NOT LOCK/UNLOCK USING THE REMOTE KEYLESS ENTRY TRANSMITTER

Test Step	Result / Action to Take
K1 CHECK FOR THE CORRECT RKE TRANSMITTERS	
• Check that the correct RKE transmitters are used with the vehicle. • Make sure the RKE transmitters are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket or a dealer-installed system that may have been installed on the vehicle. • **Are all the correct RKE transmitters present?**	**Yes** GO to K2 . **No** The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters need to be present to proceed with diagnosis of the system.
K2 CHECK THE OPERATION OF THE RKE TRANSMITTER WITH THE IGNITION SWITCH IN THE OFF POSITION	
• Ignition OFF. • Check the operation of the RKE transmitter. • **Does the system operate correctly now?**	**Yes** The system is operating as designed. INFORM the customer the correct vehicle behavior is for the RKE transmitters to function only with the ignition switch in the OFF or RUN position with the transmission in PARK or NEUTRAL. **No** GO to K3 .

K3 CHECK THE POWER DOOR LOCK SYSTEM FOR CORRECT OPERATION	
• Verify the door lock/unlock operation by actuating the driver door lock control switch. • **Do all the doors lock and unlock correctly?**	**Yes** GO to K4 . **No** To diagnose the inoperative door locks, GO to Pinpoint Test C .
K4 CHECK FOR COMPLETE FUNCTIONALITY OF THE RKE TRANSMITTER(S)	
• Check all the RKE transmitter buttons for correct operation. • **Does the panic button operate correctly?**	**Yes** REPLACE the inoperative RKE transmitter. PROGRAM the new RKE transmitter using the diagnostic tool or PROGRAM all the RKE transmitters using the ignition cylinder method. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test. **No** GO to K5 .
K5 MAKE SURE THE RKE TRANSMITTER SIGNAL IS BEING RECEIVED	
• Connect the scan tool. • Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the RKE transmitter identification code (TIC). • **NOTE:** The vehicle must be electronically unlocked through the RKE transmitter or the door lock control switch prior to using any diagnostic tools. • Verify the RKE transmitter signal is being received. Press a button on the RKE transmitter while observing the diagnostic tool. • **Does the TIC show up on the diagnostic tool screen when a button is pressed?**	**Yes** GO to K6 . **No** GO to K7 .
K6 CHECK IF THE RKE TRANSMITTERS ARE PROGRAMMED	
• Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the RKE transmitter identification code (TIC) DATA. • Verify the RKE transmitters are programmed to the vehicle. • **Does the TIC displayed under the current RKE transmitter match any of the TICs**	**Yes** GO to K8 . **No** PROGRAM all of the RKE transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer that any RKE transmitters not present need to be programmed. CLEAR the DTCs.

stored in memory?	REPEAT the self-test.
K7 CHECK THE RKE TRANSMITTER BATTERY	
• Using a thin coin, open the RKE transmitter. • Do not clean any grease from the battery terminal on the back surface of the circuit board. • Verify the correct battery is being used (CR2032). • Remove the RKE transmitter battery and measure the voltage. • **Is the voltage greater than 2.5 volts?**	**Yes** GO to K9 . **No** INSTALL a new battery. Be sure the battery is seated correctly. DO NOT program the RKE transmitters. Faulty or dead batteries do not erase TICs from memory. CLEAR the DTCs. REPEAT the self-test.
K8 CHECK IF THE RKE TRANSMITTER IS OUT OF SYNCHRONIZATION WITH THE DDM	
• **NOTE:** The vehicle must be electronically unlocked through the RKE transmitter or the door lock control switch prior to using any service tools. • Retrieve any continuous DTCs with the diagnostic tool. • **Is continuous DTC B2425 stored in the DDM?**	**Yes** To diagnose the RKE transmitter out of synchronization, GO to Pinpoint Test Q . **No** GO to K9 .
K9 CHECK FOR NORMAL OPERATION WITH A KNOWN GOOD RKE TRANSMITTER	
• Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the RKE TIC DATA. • Using the customer's second RKE transmitter or a known good RKE transmitter that is correct for the vehicle, verify the RKE transmitter signal is being received. • **Does the TIC show up on the diagnostic tool when a button is pressed on the RKE transmitter?**	**Yes** REPLACE the inoperative RKE transmitter. PROGRAM all the RKE transmitter(s). REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test. **No** GO to K10 .
K10 CHECK THE DDM FOR CORRECT OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer any remote transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or

	corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test L: Panic Feature Is Inoperative

Normal Operation

When the PANIC button on the remote keyless entry (RKE) transmitter is pressed, it sends a signal to the driver door module (DDM), which sends the information to the front electronic module (FEM) to activate the alarm.

Possible Causes

- RKE transmitter battery
- RKE transmitter programming
- DDM

PINPOINT TEST L: PANIC FEATURE IS INOPERATIVE

Test Step	Result / Action to Take
L1 CHECK FOR THE CORRECT RKE TRANSMITTERS	
• Check that the correct RKE transmitters are used with the vehicle. • Make sure the RKE transmitters are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket or a dealer-installed system that may have been installed on the vehicle. • **Are all the correct RKE transmitters present?**	**Yes** GO to L2 . **No** The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters need to be present to proceed with diagnosis of the system.
L2 CHECK THE OPERATION OF THE RKE TRANSMITTER WITH THE IGNITION SWITCH IN THE OFF POSITION	
• Ignition OFF. • Check the operation of the RKE transmitter. • **Does the system operate correctly now?**	**Yes** The system is operating as designed. INFORM the customer the correct vehicle behavior is for the RKE transmitters to function only with the ignition switch in the OFF or RUN position with the transmission in PARK or NEUTRAL. **No** GO to L3 .
L3 CHECK THE HORN AND PARK LAMPS FOR CORRECT OPERATION	
• Verify the horn and park lamp operation by actuating the horn switch and turning on the park lamps.	**Yes** GO to L4 . **No**

• **Do the horn and park lamps operate correctly?**	To diagnose the inoperative park lamps, REFER to Section 417-01 . To diagnose the horn, REFER to Section 413-06 .
L4 CHECK FOR COMPLETE FUNCTIONALITY OF THE RKE TRANSMITTER(S)	
• Check all the RKE transmitter buttons for correct operation. • **Does the LOCK button operate correctly?**	**Yes** REPLACE the inoperative RKE transmitter. PROGRAM the new RKE transmitter using the diagnostic tool or PROGRAM all the RKE transmitters using the ignition cylinder method. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test. **No** GO to L5 .
L5 MAKE SURE THE RKE TRANSMITTER SIGNAL IS BEING RECEIVED	
• Connect the scan tool. • Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the RKE transmitter identification code (TIC). • **NOTE:** The vehicle must be electronically unlocked through the RKE transmitter or the door lock control switch prior to using any diagnostic tools. • Verify the RKE transmitter signal is being received. Press a button on the RKE transmitter while observing the diagnostic tool. • **Does the TIC show up on the diagnostic tool screen when a button is pressed?**	**Yes** GO to L6 . **No** GO to L7 .
L6 CHECK IF THE RKE TRANSMITTERS ARE PROGRAMMED	
• Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the RKE transmitter identification code (TIC) DATA. • Verify the RKE transmitters are programmed to the vehicle. • **Does the TIC displayed under the current RKE transmitter match any of the TICs stored in memory?**	**Yes** GO to L8 . **No** PROGRAM all of the RKE transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer that any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test.
L7 CHECK THE RKE TRANSMITTER BATTERY	

• Using a thin coin, open the RKE transmitter. • Do not clean any grease from the battery terminal on the back surface of the circuit board. • Verify the correct battery is being used (CR2032). • Remove the RKE transmitter battery and measure the voltage. • **Is the voltage greater than 2.5 volts?**	**Yes** GO to L9 . **No** INSTALL a new battery. Be sure the battery is seated correctly. DO NOT program the RKE transmitters. Faulty or dead batteries do not erase TICs from memory. CLEAR the DTCs. REPEAT the self-test.
L8 CHECK IF THE RKE TRANSMITTER IS OUT OF SYNCHRONIZATION WITH THE DDM	
• **NOTE:** The vehicle must be electronically unlocked through the RKE transmitter or the door lock control switch prior to using any service tools. • Retrieve any continuous DTCs with the diagnostic tool. • **Is continuous DTC B2425 stored in the DDM?**	**Yes** To diagnose the RKE transmitter out of synchronization, GO to Pinpoint Test Q . **No** GO to L9 .
L9 CHECK FOR NORMAL OPERATION WITH A KNOWN GOOD RKE TRANSMITTER	
• Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the RKE TIC DATA. • Using the customer's second RKE transmitter or a known good RKE transmitter that is correct for the vehicle, verify the RKE transmitter signal is being received. • **Does the TIC show up on the diagnostic tool when a button is pressed on the RKE transmitter?**	**Yes** REPLACE the inoperative RKE transmitter. PROGRAM all the RKE transmitter(s). REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test. **No** GO to L10 .
L10 CHECK THE DDM FOR CORRECT OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer any remote transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test M: The Auto-lock Does Not Operate Correctly

Normal Operation

The auto-locking function causes the vehicle to automatically lock all doors when all of the following conditions are concurrently met during the current key cycle:

- all the doors are closed
- the auto-locking function is active
- the ignition switch is in the ON position
- the transmission is in DRIVE or REVERSE
- the vehicle speed exceeds 5 km/h (3 mph)

After the initial activation of auto-locking and at least 1 door has been opened, auto-locking is activated again if the following conditions are concurrently met:

- all the doors are closed
- the auto-locking function is active
- the ignition switch is in the ON position
- the transmission is in DRIVE or REVERSE
- the vehicle speed exceeds 5 km/h (3 mph)

Possible Causes

- door ajar switches
- driver door module (DDM)
- vehicle speed sensor (VSS) message from the anti-lock brake system (ABS) module
- digital transmission range (TR) sensor message from the powertrain control module (PCM)

PINPOINT TEST M: THE AUTO-LOCK DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
M1 CHECK THE DRIVER DOOR AJAR PID	
• Ignition OFF. • Connect the scan tool. • Ignition ON. • Close all the doors and the luggage compartment lid. • Enter the following diagnostic mode on the scan tool: FEM PID. • Monitor the front electronic module (FEM) driver door ajar PID. • **Does the FEM driver door ajar PID read AJAR?**	**Yes** REFER to Section 417-02 to diagnose the door ajar switch. **No** GO to M2 .

M2 CHECK THE RH FRONT DOOR AJAR PID	
• Enter the following diagnostic mode on the scan tool: FEM PID. • Monitor the FEM RH front door ajar PID. • **Does the FEM RH front door ajar PID read AJAR?**	**Yes** REFER to Section 417-02 to diagnose the door ajar switch. **No** GO to M3 .
M3 CHECK THE LH REAR DOOR AJAR PID	
• Enter the following diagnostic mode on the scan tool: REM PID. • Monitor the rear electronic module (REM) LH rear door ajar PID. • **Does the REM LH rear door ajar PID read AJAR?**	**Yes** REFER to Section 417-02 to diagnose the door ajar switch. **No** GO to M4 .
M4 CHECK THE RH REAR DOOR AJAR PID	
• Enter the following diagnostic mode on the scan tool: REM PID. • Monitor the REM RH rear door ajar PID. • **Does the REM RH rear door ajar PID read AJAR?**	**Yes** REFER to Section 417-02 to diagnose the door ajar switch. **No** GO to M5 .
M5 CHECK THE LUGGAGE COMPARTMENT LID AJAR PID	
• Enter the following diagnostic mode on the scan tool: REM PID. • Monitor the REM luggage compartment lid ajar PID.	**Yes** REFER to Section 417-02 to diagnose the luggage compartment lid ajar switch. **No** GO to M6 .

• **Does the REM luggage compartment lid ajar PID read AJAR?**	
M6 CHECK THE IGNITION SWITCH POSITION STATUS	
• Enter the following diagnostic mode on the scan tool: FEM PID. • Monitor the FEM ignition switch position PID. • Enter the following diagnostic mode on the scan tool: FEM PID. • Monitor the FEM VSS PID. • Enter the following diagnostic mode on the scan tool: PCM PID. • Monitor the PCM digital transmission range sensor PID. • **Are the FEM and PCM PIDs correct?**	**Yes** GO to M7 . **No** If the FEM ignition switch position PID is incorrect, REFER to Section 211-05 to diagnose the ignition switch. If the FEM VSS PID is incorrect, REFER to Section 206-09 to diagnose the VSS signal. If the PCM TR sensor PID is incorrect, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the digital TR sensor.
M7 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote keyless entry (RKE) transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: The Smart Lock Does Not Operate Correctly

Normal Operation

The smart unlocking function helps prevent the driver from locking the keys in the vehicle. When the driver or passenger door is ajar, the key is in the ignition switch, and the driver door lock control switch is pressed, all the doors lock, then the driver door unlocks. When the driver or passenger door is ajar, the key is in the ignition switch, and the passenger door lock control switch is pressed, all the doors lock, then all the doors unlock.

Possible Causes

- driver door ajar switch
- passenger door ajar switch
- driver door module (DDM)

PINPOINT TEST N: THE SMART LOCK DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
N1 CHECK THE COURTESY LAMP OPERATION	
• Open the driver door. • **Do the courtesy lamps illuminate?**	**Yes** GO to N2 . **No** REFER to Section 417-02 to diagnose the interior lighting.
N2 CHECK THE WARNING CHIME OPERATION	
• Ignition ON. • Open the driver door. • **Do the warning chimes operate correctly?**	**Yes** GO to N3 . **No** REFER to Section 413-01 to diagnose the warning chimes.
N3 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote keyless entry (RKE) transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

concern is still present. • **Is the concern still present?**	

Pinpoint Test O: The Luggage Compartment Lid Is Inoperative Using The Remote Keyless Entry Transmitter

Normal Operation

When the luggage compartment lid release button on the remote keyless entry (RKE) transmitter is pressed, it sends a signal to the driver door module (DDM), which sends a message through the standard corporate protocol (SCP) network to the rear electronic module (REM) to energize the luggage compartment lid actuator.

Possible Causes
- RKE transmitter battery
- RKE transmitter programming
- DDM

PINPOINT TEST O: THE LUGGAGE COMPARTMENT LID IS INOPERATIVE USING THE REMOTE KEYLESS ENTRY TRANSMITTER

NOTE: The luggage compartment lid key cylinder does not arm/disarm the perimeter alarm. Once armed, the perimeter alarm can only be disarmed using the RKE transmitter or the driver set/reset switch.

Test Step	Result / Action to Take
O1 TEST THE LUGGAGE COMPARTMENT LID REMOTE SWITCH	
• Press the luggage compartment lid remote switch. • **Does the luggage compartment lid open?**	**Yes** GO to O2 . **No** GO to Pinpoint Test A to diagnose the inoperative luggage compartment lid from the remote switch.
O2 CHECK THE RKE TRANSMITTER LUGGAGE COMPARTMENT LID RELEASE BUTTON WITH THE DIAGNOSTIC TOOL	
• Ignition OFF. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the DDM function test TIC/DATA.	**Yes** GO to O4 . **No** GO to O3 .

• Press the luggage compartment lid release button on the RKE transmitter while monitoring the DDM FUNCTION TEST TIC/DATA. • **Does last received data indicate TRUNK?**	
O3 CHECK THE BATTERY IN THE RKE TRANSMITTER	
• Install a new battery in the RKE transmitter. • Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the DDM function test TIC/DATA. • Press the luggage compartment lid release button on the RKE transmitter while monitoring the DDM FUNCTION TEST TIC/DATA. • **Does last received data indicate TRUNK?**	**Yes** TEST all the RKE transmitter functions. CLEAR the DTCs. REPEAT the self-test. **No** GO to O4 .
O4 CHECK THE PROGRAMMING OF THE RKE TRANSMITTER	
• Program all the RKE transmitters. Refer to Remote Keyless Entry Transmitter Programming in this section. • Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the DDM function test TIC/DATA. • Press the luggage compartment lid release button on the RKE transmitter while monitoring the DDM FUNCTION TEST TIC/DATA. • **Does last received data indicate TRUNK?**	**Yes** The RKE transmitter was not programmed. CLEAR the DTCs. REPEAT the self-test. **No** REPLACE the inoperative RKE transmitter. PROGRAM a new RKE transmitter to the vehicle. REFER to Remote Keyless Entry Transmitter Programming in this section. CLEAR the DTCs. REPEAT the self-test. If the concern is still present GO to O5 .
O5 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

• Operate the system and verify the concern is still present. • **Is the concern still present?**	

Pinpoint Test P: The Memory Seat Does Not Operate Correctly Using The Remote Keyless Entry Transmitter

Normal Operation

When the UNLOCK button on the remote keyless entry (RKE) transmitter is pressed, it sends a signal to the driver door module (DDM) to initiate the memory seat function if the RKE transmitter has been associated with a memory position.

Possible Causes
- RKE transmitter battery
- RKE transmitter programming
- RKE transmitter association with a memory position
- DDM

PINPOINT TEST P: THE MEMORY SEAT DOES NOT OPERATE CORRECTLY USING THE REMOTE KEYLESS ENTRY TRANSMITTER

Test Step	Result / Action to Take
P1 CHECK THE MEMORY SET SWITCH	
• Make sure the key is in the ignition lock cylinder. • Operate the memory seat using the memory set switch. • **Does the memory seat operate correctly?**	**Yes** GO to P2 . **No** REFER to Section 501-10 to diagnose the memory set switch.
P2 CHECK THE RKE TRANSMITTER BUTTONS WITH THE DIAGNOSTIC TOOL	
• Ignition OFF. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the DDM function test TIC/DATA. • Press the LOCK then the UNLOCK buttons on the RKE transmitter while monitoring the DDM FUNCTION TEST TIC/DATA. • **Does the data received indicate LOCK, then UNLOCK?**	**Yes** GO to P5 . **No** GO to P3 .

P3 CHECK THE BATTERY IN THE RKE TRANSMITTER	
• Install a new battery in the RKE transmitter. • Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the DDM function test TIC/DATA. • Press the LOCK then the UNLOCK buttons on the RKE transmitter while monitoring the DDM FUNCTION TEST TIC/DATA. • **Does the data received indicate LOCK, then UNLOCK?**	**Yes** TEST all the RKE transmitter functions. CLEAR the DTCs. REPEAT the self-test. **No** GO to P4 .
P4 CHECK THE PROGRAMMING OF THE RKE TRANSMITTER	
• Program all the RKE transmitters. Refer to Remote Keyless Entry Transmitter Programming in this section. • Enter the following diagnostic mode on the scan tool: FUNCTION TEST. • Monitor the DDM function test TIC/DATA. • Press the LOCK then the UNLOCK buttons on the RKE transmitter while monitoring the DDM FUNCTION TEST TIC/DATA. • **Does the data received indicate LOCK, then UNLOCK?**	**Yes** The RKE transmitter was not programmed. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new RKE transmitter. PROGRAM a new RKE transmitter to the vehicle. REFER to Remote Keyless Entry Transmitter Programming in this section. CLEAR the DTCs. REPEAT the self-test.
P5 CHECK THAT THE RKE TRANSMITTER IS ASSOCIATED WITH A MEMORY POSITION	
• Activate the RKE transmitter memory recall feature. • Position the seat, mirrors, steering column, and adjustable pedals to the desired positions and program the settings into the RKE transmitter. • Press the unlock button on the RKE transmitter. • **Does the RKE transmitter operate correctly?**	**Yes** The system is operating correctly at this time. INFORM the customer of the correct process to program the RKE transmitter to a memory position. **No** GO to P6 .
P6 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the remote keyless entry (RKE) transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. CLEAR the DTCs. REPEAT

• Connect all the DDM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test Q: The Remote Keyless Entry Transmitter Is Out Of Synchronization

Normal Operation

The remote keyless entry (RKE) transmitters and the driver door module (DDM) use a rolling code to prevent the codes from being captured by a code grabber. The system advances the counter in the RKE transmitter and in the DDM every time an RKE transmitter button is pressed.

All RKE transmitters must be present to begin diagnosis of the RKE system.

Possible Causes
- RKE transmitter
- DDM
- RKE transmitter button pressed a substantial amount of times while outside the range of the vehicle

PINPOINT TEST Q: THE REMOTE KEYLESS ENTRY TRANSMITTER IS OUT OF SYNCHRONIZATION

Test Step	Result / Action to Take
Q1 RESYNCHRONIZE THE INOPERATIVE RKE TRANSMITTER	
• Ignition OFF. • Press any button on the inoperative RKE transmitter 4 times consecutively within 30 seconds. • **Does the RKE transmitter operate correctly?**	**Yes** The system is OK. CLEAR the DTCs. REPEAT the self-test. **No** GO to Q2 .
Q2 CHECK FOR A SECOND RKE TRANSMITTER	
• Check for another RKE transmitter that operates with the vehicle. • **Is there another RKE transmitter that operates with the vehicle?**	**Yes** GO to Q3 . **No** GO to Q4 .
Q3 RESYNCHRONIZE THE INOPERATIVE RKE TRANSMITTER USING THE SECOND RKE TRANSMITTER	
• Ignition OFF. • Press any button on the operational RKE transmitter. • Within 30 seconds, press a button on the inoperative RKE transmitter. • Check the inoperative RKE transmitter for correct operation.	**Yes** The system is OK. CLEAR the DTCs. REPEAT the self-test. **No** GO to Q4 .

• **Does the inoperative RKE transmitter operate now?**	
Q4 PROGRAM ALL THE RKE TRANSMITTERS	
• Program the inoperative RKE transmitter individually using a diagnostic tool or program all RKE transmitters using the manual key cycle method. Refer to Remote Keyless Entry Transmitter Programming in this section. • **Does the inoperative RKE transmitter operate now?**	**Yes** The system is OK. INFORM the customer that any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test. **No** To diagnose the inoperative RKE transmitter, GO to Pinpoint Test K .

Pinpoint Test R: The Remote Keyless Entry Transmitter Has Poor Range Performance

Normal Operation

Remote locking and unlocking of the doors is accomplished by the driver door module (DDM) receiving a command message from the remote keyless entry (RKE) transmitter. The DDM processes the command and sends a signal directly to the driver door latch. The DDM sends a message through the standard corporate protocol (SCP) network to the rear electronic module (REM), which activates the passenger door latches. The RKE transmitter has a minimum acceptable operating range of 10 m (33 feet).

All RKE transmitters must be present to begin diagnosis of the RKE system.

Aftermarket or dealer-installed system may adversely affect the RKE system operation. These systems should be disconnected before diagnosing any RKE concerns.

Possible Causes
- aftermarket system
- high power devices
- TV/radio transmission towers
- RKE transmitter
- DDM

PINPOINT TEST R: THE REMOTE KEYLESS ENTRY TRANSMITTER HAS POOR RANGE PERFORMANCE

Test Step	Result / Action to Take
R1 CHECK FOR THE CORRECT RKE TRANSMITTERS	
• Check that the correct RKE transmitters are used with the vehicle. • Make sure the RKE transmitters are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket or a dealer-installed system that may have been installed on the vehicle.	**Yes** GO to R2 . **No** The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters need to be present to proceed with diagnosis of the system.

• **Are all the correct RKE transmitters present?**	
R2 CHECK ALL RKE TRANSMITTERS FOR POOR RANGE PERFORMANCE	
NOTE: The 3 m (10 ft) measurement of range is not the standard, but is a guideline that clearly indicates a vehicle is experiencing poor range performance. • Check all the RKE transmitters for poor range performance (less than 3 m [10ft]). • **Do all RKE transmitters experience poor range?**	**Yes** GO to R3 . **No** REPLACE the inoperative RKE transmitter and PROGRAM all the RKE transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test.
R3 CHECK THE LOCATION OF THE VEHICLE AND THE APPROACH ANGLES AROUND VEHICLE	
• Make sure the poor performance is consistent in nature and not from one approach angle. • The RKE transmitter range performance may be degraded in certain locations. For example, if the vehicle is within 0.8 km (0.5 miles) of high power devices or radio/TV towers, the operating distance of the transmitters may be reduced. • **Is the poor range performance consistent around the vehicle?**	**Yes** GO to R4 . **No** The system is operating correctly at this time. CLEAR the DTCs. REPEAT the self-test.
R4 CHECK THE DDM FOR CORRECT OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . PROGRAM all the RKE transmitters. REFER to Remote Keyless Entry Transmitter Programming in this section. INFORM the customer any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Remote Keyless Entry Transmitter Programming

NOTE: All remote keyless entry (RKE) transmitters must be programmed at the same time.

NOTE: Programming of the RKE transmitters can be accomplished using a scan tool or by carrying out the following steps:

1. The vehicle must be electronically unlocked before entering program mode using the RKE transmitter, keyless entry keypad (if equipped) or door lock control switch while the driver door is open.

2. Turn the key from OFF to RUN 8 times within 10 seconds, with the eighth turn ending in RUN. If the module successfully enters the program mode, it locks and then unlocks all doors.

3. Within 20 seconds, press any button on an RKE transmitter, and the doors lock and then unlock to confirm that each RKE transmitter is programmed. Repeat this step for each RKE transmitter.

4. If the door locks do not respond for any RKE transmitter, wait several seconds and press the button again. If the door locks still fail to respond, refer to Inspection and Verification in this section. Make sure that no more than the maximum number of 4 RKE transmitters are attempted to be programmed.

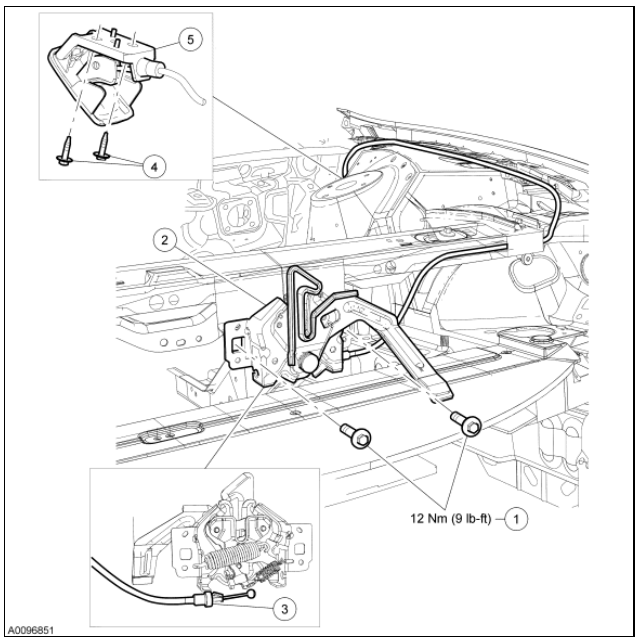
5. Exiting the programming mode is accomplished if one of the following occurs:
   - The key transitions to the OFF position.
   - Twenty seconds have passed since entering programming mode or since the last RKE transmitter was programmed.
   - The maximum number of 4 RKE transmitters have been programmed.

Stepped Unlock Programming

1. With the ignition switch in the OFF position, press the LOCK and UNLOCK buttons on the Remote Keyless Entry (RKE) transmitter simultaneously for 4 seconds.
    - The turn signals will flash twice to indicate the mode change.

2. Repeat Step 1 to enable/disable the stepped unlocking feature.

Hood Latch and Components — Exploded View



Item	Part Number	Description
1	N808727	Hood latch bolts (2 required)
2	16700	Hood latch
3	—	Hood latch release cable (part of 16916)
4	—	Hood latch release handle screws (2 required)
5	16916	Hood latch release handle and cable assembly

1. For additional information, refer to the procedures in this section.

Hood Latch

Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

Removal and Installation

1. **NOTE:** Mark the hood latch prior to the removal of the bolts.

   Remove the 2 hood latch bolts.

   - To install, tighten to 12 Nm (9 lb-ft).

2. Position the hood latch up.

3. Disconnect the hood latch release cable and remove the hood latch.
   - Lubricate the hood latch after installation.

4. To install, reverse the removal procedure.
   - When a new hood latch is installed, the latch adjustment must be checked to make sure the latch is installed correctly.

Hood Latch Release Handle

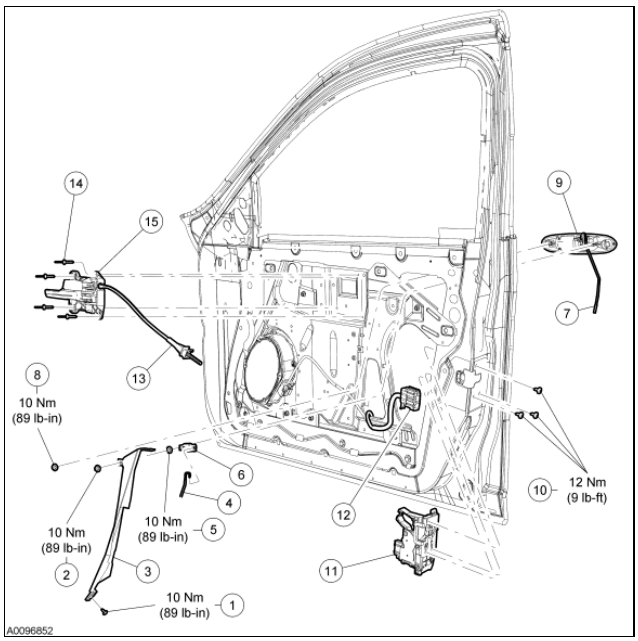
Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

Removal and Installation

1. Remove the hood latch. For additional information, refer to Hood Latch in this section.
2. Remove the 2 screws and the hood latch release handle and cable assembly.
3. To install, reverse the removal procedure.

Front Door Handles, Locks and Latches — Exploded View



Item	Part Number	Description
1	N811471	Front door latch shield screw
2	N621906	Front door latch shield nut
3	5421978/ 5421979	Front door latch shield (RH/LH)
4	219A64	Lock cylinder actuating rod (if equipped)
5	N621906	Door lock cylinder nut (if equipped)
6	21991	Door lock cylinder (if equipped)
7	22152	Exterior door handle actuating rod
8	W520111	Exterior front door handle nut
9	5422405	Exterior front door handle
10	N81147	Front door latch screws (3 required)
11	54218812	Front door latch
12	14A099	Front door latch electrical connector
13	5421818	Interior front door handle cable
14	—	Interior front door handle rivets (4 required)
15	5421818	Interior front door handle

1. For additional information, refer to the procedures in this section.

Front Door Latch

Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

Removal and Installation

NOTE: The passenger side is shown, the driver side is similar.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Remove the front door latch shield screw.
   - To install, tighten to 10 Nm (89 lb-in).
3. Remove the front door latch shield nut.
   - To install, tighten to 10 Nm (89 lb-in).
4. Remove the front door latch shield.
5. If equipped, disconnect the lock cylinder actuating rod.
6. Disconnect the exterior door handle actuating rod.
7. Remove the 3 front door latch screws.
   - To install, tighten to 12 Nm (9 lb-ft).
8. Position the front door latch aside.
9. Disconnect the electrical connector and remove the front door latch.
10. To install, reverse the removal procedure.
    - Lubricate the front door latch after it is installed.

Exterior Front Door Handle

Removal and Installation

NOTE: The passenger side is shown, the driver side is similar.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .

2. Remove the front door latch shield screw.
   - To install, tighten to 10 Nm (89 lb-in).

3. Remove the front door latch shield nut.
   - To install, tighten to 10 Nm (89 lb-in).

4. Remove the front door latch shield.

5. If equipped, remove the door lock cylinder nut.
   - To install, tighten to 10 Nm (89 lb-in).

6. Disconnect the exterior front door handle actuating rod.

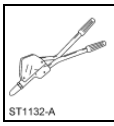
7. Remove the exterior front door handle nut.
   - To install, tighten to 10 Nm (89 lb-in).

8. Remove the exterior front door handle.

9. To install, reverse the removal procedure.

Interior Door Handle — Front

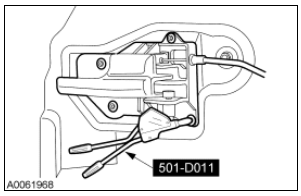
Special Tool(s)

 ST1132-A	Heavy Duty Riveter 501-D011 (D80L-23200-A)

Removal and Installation

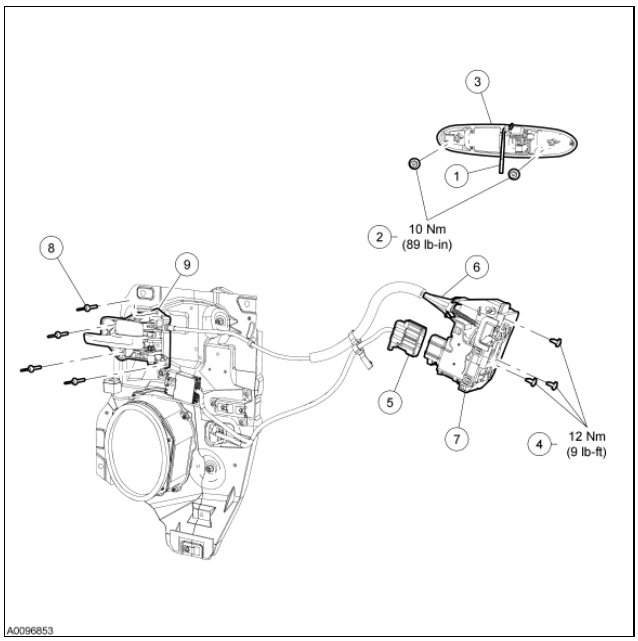
NOTE: The passenger side is shown, the driver side is similar.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Remove the front door latch. For additional information, refer to Front Door Latch in this section.
3. Remove the 4 interior front door handle rivets.
   - Use the special tool to install the new rivets.



4. Remove the interior front door handle.
5. To install, reverse the removal procedure.

Rear Door Handles, Locks and Latches — Exploded View



Item	Part Number	Description
1	5422400	Exterior rear door handle actuating rod
2	N621906	Exterior rear door handle nuts (2 required)
3	5426604/ 5426605	Exterior rear door handle (RH/LH)
4	11471	Rear door latch screws (3 required)
5	14A464	Rear door latch electrical connector
6	5421B18	Rear door actuating cable
7	54203A28/ 54203A29	Rear door latch (RH/LH)
8	5403A28A	Interior rear door handle rivets (4 required)
9	5421818	Interior rear door handle

1. For additional information, refer to the procedures in this section.

Rear Door Latch

Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the exterior rear door handle actuating rod.
3. Remove the 3 rear door latch screws.
   - To install, tighten to 12 Nm (9 lb-ft).
4. Disconnect the rear door latch electrical connector.
5. Disconnect the rear door actuating cable.
6. Remove the rear door latch.
7. To install, reverse the removal procedure.
   - Lubricate the rear door latch after installation.

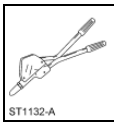
Exterior Rear Door Handle

Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the exterior rear door handle actuating rod.
3. Remove the 2 nuts and the exterior door handle.
   - To install, tighten to 10 Nm (89 lb-in).
4. To install, reverse the removal procedure.

Interior Door Handle — Rear

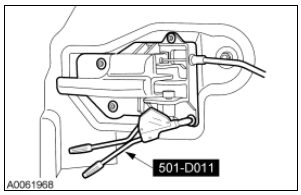
Special Tool(s)

 ST1132-A	Heavy Duty Riveter 501-D011 (D80L-23200-A)

Removal and Installation

1. Remove the rear door latch. For additional information, refer to Rear Door Latch in this section.

2. Remove the 4 interior rear door handle rivets.
   - Use the special tool to install the new rivets.



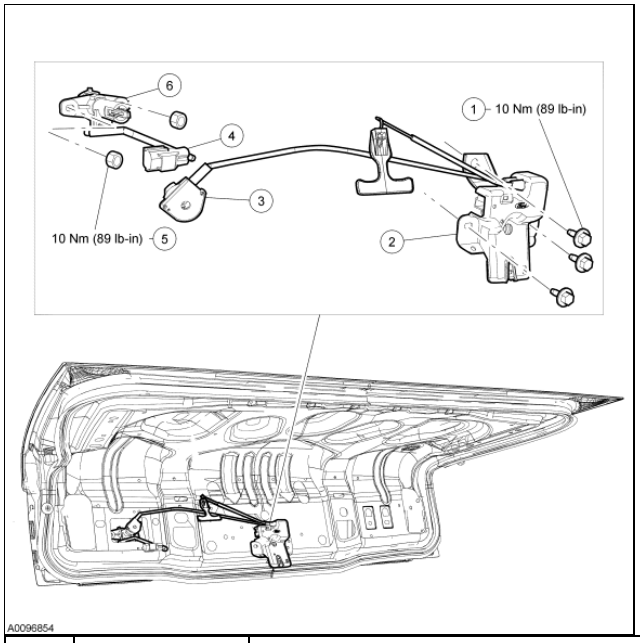
3. Remove the interior rear door handle.

4. To install, reverse the removal procedure.

Luggage Compartment Lid Latch

Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B



Item	Part Number	Description
1	N807260	Luggage compartment lid latch bolts (3 required)
2	5443200	Luggage compartment lid latch
3	5422400	Luggage compartment lid actuating cable
4	11471	Luggage compartment lid lock cylinder electrical connector
5	N806385	Luggage compartment lid lock cylinder nuts (2 required)
6	5443262	Luggage compartment lid lock cylinder

Removal and Installation

1. Remove the luggage compartment lid trim panel.

2. Disconnect the luggage compartment latch electrical connector.

3. Remove the 3 luggage compartment lid latch bolts.
   - To install, tighten to 10 Nm (89 lb-in).

4. Position the luggage compartment lid latch aside.

- When a new luggage compartment lid latch is installed, the latch adjustment must be checked to make sure the latch was installed correctly.

5. Disconnect the luggage compartment lid actuating cable.

6. To install, reverse the removal procedure.
   - Lubricate the luggage compartment lid latch after it is installed.

Door Lock Cylinder

Removal and Installation

⚠ WARNING: Disconnect the battery ground cable when working on or near the driver side door cylinder lock rod or door latch. Failure to follow these instructions may result in personal injury.

NOTE: The passenger side is shown, the driver side is similar.

NOTE: When any new lock cylinder is installed, the luggage compartment lid lock cylinder, the driver door lock cylinder, and ignition lock cylinder should be installed as a set. This eliminates carrying an extra key that fits only 1 lock. If a new key is used, the new key code number is stamped on a metal tag attached to the key.

NOTE: Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

1. Disconnect the battery. For additional information, refer to Section 414-01 .

2. Remove the front door trim panel. For additional information, refer to Section 501-05 .

3. Remove the front door latch shield screw.
   - To install, tighten to 10 Nm (89 lb-in).

4. Remove the front door latch shield nut.
   - To install, tighten to 10 Nm (89 lb-in).

5. Remove the front door latch shield.

6. Remove the nut and the door lock cylinder.
   - To install, tighten to 10 Nm (89 lb-in).

7. To install, reverse the removal procedure.

Luggage Compartment Lid Lock Cylinder

Removal and Installation

NOTE: When any new lock cylinder is installed, the luggage compartment lid lock cylinder, the driver door lock cylinder, and ignition lock cylinder should be installed as a set. This eliminates carrying an extra key that fits only 1 lock. If a new key is used, the new key code number is stamped on a metal tag attached to the key.

NOTE: Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

1. Remove the luggage compartment lid trim panel.

2. Disconnect the luggage compartment lid lock cylinder electrical connector.

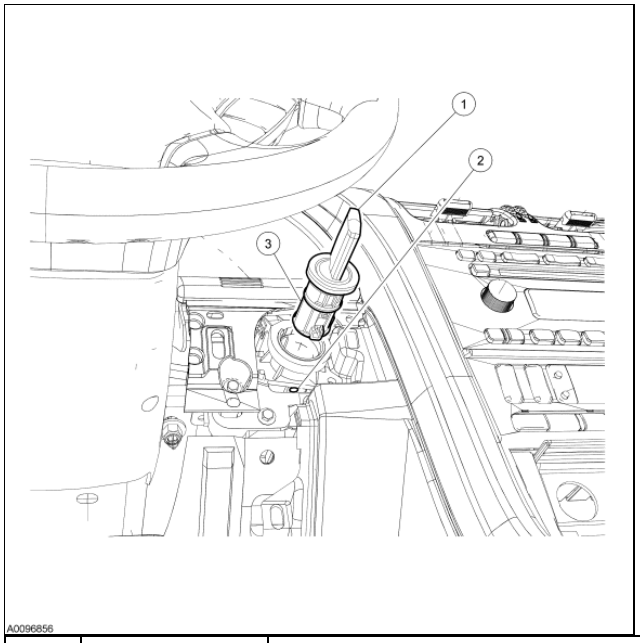
3. Remove the 2 nuts and the luggage compartment lid lock cylinder.
   - To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.

Ignition Lock Cylinder

Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B



Item	Part Number	Description
1	7822053	Ignition key
2	—	Ignition lock cylinder release button (part of 11583)
3	11583	Ignition lock cylinder

Removal and Installation

NOTE: When any new lock cylinder is installed, the luggage compartment lid lock cylinder, the driver door lock cylinder, and ignition lock cylinder should be installed as a set. This eliminates carrying an extra key that fits only 1 lock. If a new key is used, the new key code number is stamped on a metal tag attached to the key.

NOTE: Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

1. Disconnect the battery and wait at least 1 minute to allow for depletion of the restraint system back up power supply. For additional information refer to Section 414-01 .

2. Remove the steering column cover. For additional information, refer to Section 501-12 .

3. Remove the inner instrument panel finish panel.

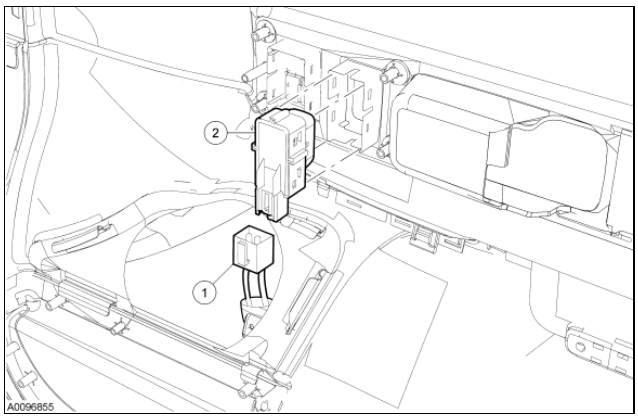
4. Turn the ignition switch to the RUN position.

5. Using a small flat-blade screwdriver, press and hold the ignition lock cylinder release button.

6. Remove the ignition lock cylinder.

7. To install, reverse the removal procedure.
    - Lubricate the ignition lock cylinder before installation.

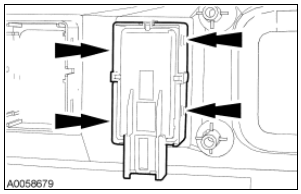
Door Lock Control Switch



Item	Part Number	Description
1	14A205/14B121	Door lock control switch electrical connector
2	14028	Door lock control switch

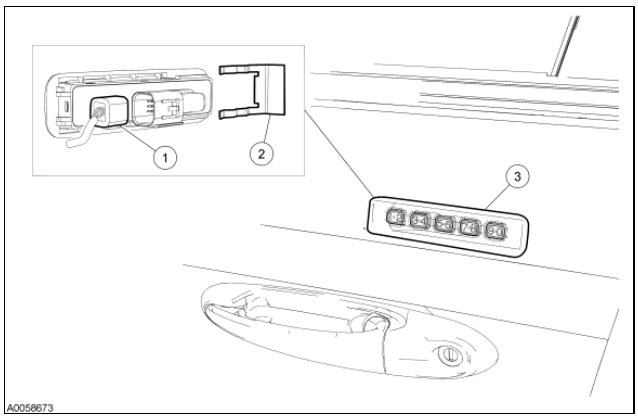
Removal and Installation

1. Remove the door trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the door lock control switch electrical connector.
3. Release the switch from the locking tabs.



4. Remove the door lock control switch.
5. To install, reverse the removal procedure.

Remote Keyless Entry Keypad



Item	Part Number	Description
1	—	Remote keyless entry (RKE) keypad electrical connector (part of 14K138)
2	14A667	RKE keypad retaining clip (part of 14A626)
3	14A626	RKE keypad

Removal and Installation

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the RKE keypad electrical connector.
3. Remove the RKE keypad retaining clip.
4. Remove the RKE keypad.
5. To install, reverse the removal procedure.

General Specifications

Item	Specification
LH wiper blade adjustment tolerance	10 mm (0.39 in)
RH wiper blade adjustment tolerance	12 mm (0.47 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Degas bottle bolts	10	—	89
Mounting arm and pivot shaft bolts	12	9	—
Strut tower support brace bolts	20	15	—
Windshield washer reservoir screws	6	—	53
Windshield wiper motor bolt	15	11	—
Windshield wiper motor crank bolt	17	13	—
Windshield wiper pivot arm nuts	25	18	—

Wipers and Washers

The wipers and washer system includes the following components:

- pivot arms
- windshield wiper motor
- mounting arm and pivot shaft assembly
- windshield washer pump
- windshield washer reservoir

Wipers and Washers

Refer to Wiring Diagrams Cell 81 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1138-A	Flex Probe Kit 105-R025B or equivalent
ST1453-A	SABRE Premium Battery and Electrical System Tester 010-00736 or equivalent

Principles Of Operation

The windshield wiper motor receives inputs from the following: multifunction switch, ignition switch, auxiliary junction box (AJB), and central junction box (CJB). The wiper and washer systems are controlled by the smart wiper motor. The wiper/washer portion of the multifunction switch is hardwired to the smart wiper motor. When the switch is moved to the desired position, the smart wiper motor processes this information and outputs the appropriate command(s) to one of the 3 internal relays. The relays control the wiper high and low motor speeds and washer pump actuation.

The following components are integrated into the windshield wiper motor: the windshield wiper motor module, high/low speed relay, run/park sensor (Hall-effect), and the washer pump relay.

High Speed Windshield Wipers

High speed operation is activated when the multifunction switch supplies a ground to the wiper motor module input. This ground is applied to the run/park and high/low relays contained in the wiper motor electronics, activating the relays and providing high speed operation. The windshield wiper motor module continues to cycle the windshield wiper in high speed operation until the inputs from the multifunction switch are changed from the high speed position.

Low Speed Windshield Wipers

Low speed operation is activated when the multifunction switch supplies a specific ground to the inputs of the windshield wiper motor module. The windshield wiper motor module then supplies a ground to the windshield wiper run/park relay coil, activating the coil. The run/park relay and high/low relay are contained in the wiper motor electronics. When the windshield wiper run/park relay is activated, the deactivated windshield high/low relay connects voltage to the windshield wiper motor low input, activating the wiper

motor. The windshield wiper motor module continues to operate the windshield wiper motor in the same manner as in high speed, but in low speed with the wiper motor connected to the low speed input.

Intermittent Speed Windshield Wipers

The 5 intermittent wiper dwell times are activated with grounds controlled by the multifunction switch inputs to the windshield wiper motor module. When in intermittent mode of operation, the wiper motor operates in low speed. Once the windshield wiper motor module receives the necessary inputs from the multifunction switch, the module then activates the windshield wiper run/park relay coil and switches voltage through the windshield wiper high/low relay. The high/low relay remains deactivated, supplying the voltage to the wiper motor low speed input and activating the windshield wiper motor. When the windshield wiper motor module receives the grounded input, the motor continues to operate until the Hall-effect sensor senses the wiper motor magnet, which turns off the run/park sensor output to the windshield wiper run/park software, deactivating the relay and disconnecting voltage to the wiper motor. The windshield wipers remain parked until the windshield wiper motor module completes a time-out and then repeats the intermittent windshield wiper cycle.

Software Safe Mode

The windshield wiper motor defaults to this mode when the Hall-effect sensor signal is lost. This can be caused by an obstruction of the windshield wipers, a binding linkage, or an electronics concern. The motor operates in either low or high speeds; intermittent operation is not available. The windshield wipers do not park correctly in this situation and must be manually walked down the glass by changing the multifunction switch input to the wiper motor module (OFF to Low).

Washer System

The windshield washer is activated by the internal windshield wiper motor module when it receives a ground from the multifunction switch from the washer input. Dependent on the correct ground, the internal windshield wiper motor module activates the windshield washer relay (internal) by grounding the respective relay coil. When the relay is activated, it connects voltage to the washer pump while the washer level switch provides ground to the washer pump.

Low Washer Fluid Level Lamp/Indicator

The low washer fluid lamp/indicator feature is controlled by the front electronic module (FEM) and the instrument cluster. The low washer fluid switch is hardwired to the FEM. If the fluid level is low, the FEM sends a message through the standard corporate protocol (SCP) communication network to the instrument cluster. The instrument cluster then processes the message and outputs an audible and visual warning. If equipped with a message center, a warning message is displayed. For additional information, refer to Section 413-01 .

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Hoses to windshield washer pump • Wiper linkage	• Auxiliary junction box (AJB) fuse 20 (30A) • Central junction box (CJB) fuse 26 (5A) • Circuitry • Front electronic module (FEM) • Multifunction switch • Wiper motor • Washer pump

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the tool menu. If the diagnostic does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP, UBP or ISO circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for FEM, refer to section Section 419-10 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out the self-test for the FEM.

7. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Failure	FEM	CLEAR the DTC. REPEAT the FEM self-test. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 . REPEAT the self-test.
B1479	Low Washer Fluid Level Switch Circuit Failure	FEM	REPAIR the low washer fluid indicator lamp. REFER to Section 413-01 for the correct diagnostic direction.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Wipers Are Inoperative

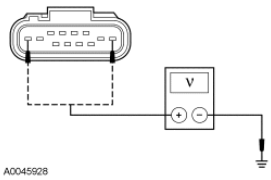
Normal Operation

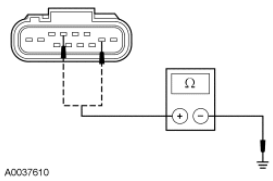
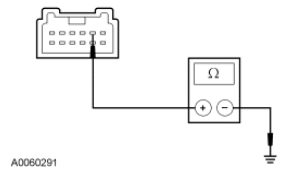
The windshield wiper motor receives inputs from the multifunction switch circuits 8-KA8 (WH/RD), 10-KA8 (GY/RD), 8-KA11 (WH/BK), and 8-KA10 (WH/GN). The windshield wiper motor module (internal) then controls the wiper run/park relay (internal) using internal circuitry to control the windshield wiper motor in conjunction with the wiper HI/LO relay (internal).

Possible Causes

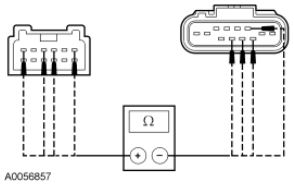
- fuse(s)
- circuit 8-KA8 (WH/RD) open
- circuit 8-KA10 (WH/GN) open
- circuit 8-KA11 (WH/BK) open
- circuit 10-KA8 (GY/RD) open
- circuit 30-KA8 (RD/BU) open
- circuit 31-KA8 (BK/BU) open
- circuit 31-KA19 (BK/RD) open
- circuit 75-KA8 (YE/RD) open
- circuit 91-KA8 (BN/RD) open
- multifunction switch
- windshield wiper motor

PINPOINT TEST A: THE WIPERS ARE INOPERATIVE

Test Step	Result / Action to Take
A1 CHECK CIRCUITS 30-KA8 (RD/BU) AND 75-KA8 (YE/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125. • Ignition ON. • Measure the voltage between the windshield wiper motor C125-5, circuit 30-KA8 (RD/BU), harness side and ground; and between the windshield wiper motor C125-8, circuit 75-KA8 (YE/RD), harness side and ground.  • **Are the voltages greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY the auxiliary junction box (AJB) fuse 20 (30A) and the central junction box (CJB) fuse 26 (5A) are OK. If OK, REPAIR the circuit(s) in question. TEST the system for normal operation.
A2 CHECK CIRCUITS 31-KA8 (BK/BU) AND 91-KA8 (BN/RD) FOR AN OPEN	

• Ignition OFF. • Measure the resistance between the windshield wiper motor C125-6, circuit 31-KA8 (BK/BU), harness side and ground; and between the windshield wiper motor C125-3, circuit 91-KA8 (BN/RD), harness side and ground.  • **Are the resistances less than 5 ohms?**	**Yes** GO to A3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
A3 CHECK THE MULTIFUNCTION SWITCH	
• Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the multifunction switch pass the component test?**	**Yes** GO to A4 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
A4 CHECK CIRCUIT 31-KA19 (BK/RD) FOR AN OPEN	
• Measure the resistance between the multifunction switch C202-2, circuit 31-KA19 (BK/RD), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to A5 . **No** REPAIR the circuit. TEST the system for normal operation.
A5 CHECK CIRCUITS 8-KA8 (WH/RD), 8-KA10 (WH/GN), 8-KA11 (WH/BK), AND 10-KA8 (GY/RD) FOR AN OPEN	
• Using the following table, measure the resistance between the multifunction switch C202, harness side and the windshield wiper motor C125, harness side: **Multifunction Switch** / **Windshield Wiper Motor** / **Circuit** C202-1 / C125-10 / 8-KA8 (WH/RD)	**Yes** GO to A6 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

C202-3	C125-9	8-KA10 (WH/GN)
C202-4	C125-11	10-KA8 (GY/RD)
C202-6	C125-1	8-KA11 (WH/BK)



- **Are the resistances less than 5 ohms?**

A6 CHECK FOR CORRECT WIPER MOTOR OPERATION	

• Disconnect all the wiper motor connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to A7 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

A7 CHECK THE WINDSHIELD WIPER MOTOR	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125. • Carry out the windshield wiper motor component test as described in this section. • **Does the windshield wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. The concern may have been caused by binding or an incorrect pivot arm adjustment. REFER to Windshield Wiper Blade and Pivot Arm Adjustment in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Windshield Wiper Motor in this section. TEST the system for normal operation.

Pinpoint Test B: The Wipers Stay On Continuously

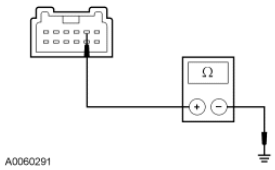
Normal Operation

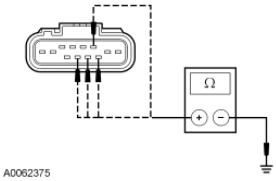
The windshield wiper motor receives inputs from the multifunction switch circuits 8-KA8 (WH/RD), 10-KA8 (GY/RD), 8-KA11 (WH/BK), and 8-KA10 (WH/GN). The windshield wiper motor module (internal) controls the wiper run/park relay (internal) using internal circuitry to control the windshield wiper motor in conjunction with the wiper HI/LO relay (internal).

Possible Causes

- circuit 8-KA8 (WH/RD) short to ground
- circuit 8-KA10 (WH/GN) short to ground
- circuit 8-KA11 (WH/BK) short to ground
- circuit 10-KA8 (GY/RD) short to ground
- circuit 31-KA19 (BK/RD) open
- windshield wiper motor
- multifunction switch

PINPOINT TEST B: THE WIPERS STAY ON CONTINUOUSLY

Test Step	Result / Action to Take
B1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the multifunction switch pass the component test?**	**Yes** GO to B2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
B2 CHECK CIRCUIT 31-KA19 (BK/RD) FOR AN OPEN	
• Measure the resistance between the multifunction switch C202-2, circuit 31-KA19 (BK/RD), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to B3 . **No** REPAIR the circuit. TEST the system for normal operation.
B3 CHECK CIRCUITS 8-KA8 (WH/RD), 8-KA10 (WH/GN), 8-KA11 (WH/BK), AND 10-KA8 (GY/RD) FOR A SHORT TO GROUND	
• Disconnect: Windshield Wiper Motor C125. • Using the following table, measure the resistance between the windshield wiper motor C125, harness side and	**Yes** GO to B4 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

ground: **Windshield Wiper Motor** / **Circuit** C125-1 / 8-KA11 (WH/BK) C125-9 / 8-KA10 (WH/GN) C125-10 / 8-KA8 (WH/RD) C125-11 / 10-KA8 (GY/RD)  • **Are the resistances greater than 10,000 ohms?**	
B4 CHECK FOR CORRECT WINDSHIELD WIPER MOTOR OPERATION	

• Disconnect all the windshield wiper motor connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the windshield wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to B5 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

B5 CHECK THE WINDSHIELD WIPER MOTOR	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125. • Carry out the windshield wiper motor component test as described in this section. • **Does the windshield wiper motor pass the component test?**	**Yes** The system is operating correctly at this time. The concern may have been caused by a binding or an incorrect pivot arm adjustment. REFER to Windshield Wiper Blade and Pivot Arm Adjustment in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Windshield Wiper Motor in this section. TEST the

	system for normal operation.

Pinpoint Test C: The High/Low Wiper Speeds Do Not Operate Correctly (Intermittent Wiper Mode OK)

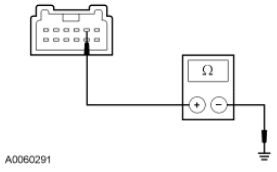
Normal Operation

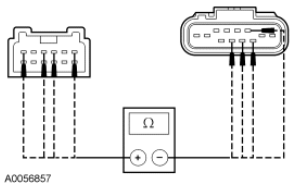
The windshield wiper motor receives inputs from the multifunction switch circuits 8-KA8 (WH/RD), 10-KA8 (GY/RD), 8-KA11 (WH/BK), and 8-KA10 (WH/GN). The windshield wiper motor module (internal) then controls the wiper run/park relay (internal) using internal circuitry to control the windshield wiper motor in conjunction with the wiper HI/LO relay (internal).

Possible Causes

- circuit 8-KA8 (WH/RD) open
- circuit 8-KA10 (WH/GN) open
- circuit 8-KA11 (WH/BK) open
- circuit 10-KA8 (GY/RD) open
- circuit 31-KA19 (BK/RD) open
- multifunction switch
- windshield wiper motor

PINPOINT TEST C: THE HIGH/LOW WIPER SPEEDS DO NOT OPERATE CORRECTLY (INTERMITTENT WIPER MODE OK)

Test Step	Result / Action to Take
C1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the multifunction switch pass the component test?**	**Yes** GO to C2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
C2 CHECK CIRCUIT 31-KA19 (BK/RD) FOR AN OPEN	
• Measure the resistance between the multifunction switch C202-2, circuit 31-KA19 (BK/RD), harness side and ground.  	**Yes** GO to C3 . **No** REPAIR the circuit. TEST the system for normal operation.

• **Is the resistance less than 5 ohms?**	
C3 CHECK CIRCUITS 8-KA8 (WH/RD), 8-KA10 (WH/GN), 8-KA11 (WH/BK), AND 10-KA8 (GY/RD) FOR AN OPEN	
• Disconnect: Windshield Wiper Motor C125. • Using the following table, measure the resistance between the multifunction switch C202, harness side, and the windshield wiper motor C125, harness side: **Multifunction Switch / Windshield Wiper Motor / Circuit** C202-1 / C125-10 / 8-KA8 (WH/RD) C202-3 / C125-9 / 8-KA10 (WH/GN) C202-4 / C125-11 / 10-KA8 (GY/RD) C202-6 / C125-1 / 8-KA11 (WH/BK)  • **Are the resistances less than 5 ohms?**	**Yes** GO to C4 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
C4 CHECK FOR CORRECT WINDSHIELD WIPER MOTOR OPERATION	

• Disconnect all the windshield wiper motor connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the windshield wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to C5 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

C5 CHECK THE WINDSHIELD WIPER MOTOR	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125.	**Yes** The system is operating correctly at this time. The concern may have been caused by a binding

• Carry out the windshield wiper motor component test as described in this section. • **Does the windshield wiper motor pass the component test?**	or an incorrect pivot arm adjustment. REFER to Windshield Wiper Blade and Pivot Arm Adjustment in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Windshield Wiper Motor in this section. TEST the system for normal operation.

Pinpoint Test D: The Intermittent Windshield Wiper Speed Does Not Operate Correctly (High/Low Speeds OK)

Normal Operation

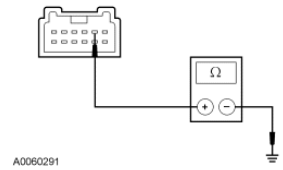
The windshield wiper motor receives inputs from the multifunction switch circuits 8-KA8 (WH/RD), 10-KA8 (GY/RD), 8-KA11 (WH/BK), and 8-KA10 (WH/GN). The windshield wiper motor module (internal) then controls the wiper run/park relay (internal) using internal circuitry to control the windshield wiper motor in conjunction with the wiper HI/LO relay (internal).

Possible Causes

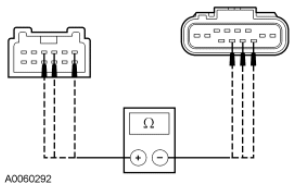
- circuit 8-KA8 (WH/RD) open
- circuit 8-KA10 (WH/GN) open
- circuit 10-KA8 (GY/RD) open
- circuit 31-KA19 (BK/RD) open
- multifunction switch
- windshield wiper motor

PINPOINT TEST D: THE INTERMITTENT WINDSHIELD WIPER SPEED DOES NOT OPERATE CORRECTLY (HIGH/LOW SPEEDS OK)

Test Step	Result / Action to Take
D1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the multifunction switch pass the component test?**	**Yes** GO to D2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
D2 CHECK CIRCUIT 31-KA19 (BK/RD) FOR AN OPEN	
• Measure the resistance between the multifunction switch C202-2, circuit 31-KA19 (BK/RD), harness side and ground.	**Yes** GO to D3 . **No** REPAIR the circuit. TEST the system for normal operation.



- **Is the resistance less than 5 ohms?**

D3 CHECK CIRCUITS 8-KA8 (WH/RD), 8-KA10 (WH/GN), AND 10-KA8 (GY/RD) FOR AN OPEN	
• Disconnect: Windshield Wiper Motor C125. • Using the following table, measure the resistance between the multifunction switch C202, harness side and the windshield wiper motor C125, harness side: **Multifunction Switch** / **Windshield Wiper Motor** / **Circuit** C202-1 / C125-10 / 8-KA8 (WH/RD) C202-3 / C125-9 / 8-KA10 (WH/GN) C202-4 / C125-11 / 10-KA8 (GY/RD)  • **Are the resistances less than 5 ohms?**	**Yes** GO to D4 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
D4 CHECK FOR CORRECT WINDSHIELD WIPER MOTOR OPERATION	

• Disconnect all the windshield wiper motor connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the windshield wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to D5 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

D5 CHECK THE WINDSHIELD WIPER MOTOR	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125.	**Yes** The system is operating correctly at this time. The concern may have been caused

• Carry out the windshield wiper motor component test as described in this section. • **Does the windshield wiper motor pass the component test?**	by a binding or an incorrect pivot arm adjustment. REFER to Windshield Wiper Blade and Pivot Arm Adjustment in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Windshield Wiper Motor in this section. TEST the system for normal operation.

Pinpoint Test E: The Wash And Wipe Functions Are Inoperative

Normal Operation

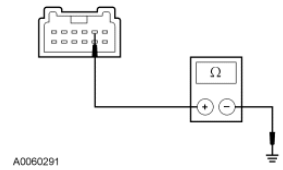
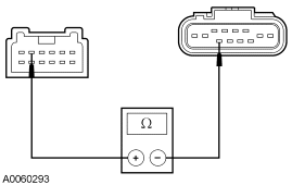
The wash and wipe function is activated when the windshield wiper motor module (internal) receives a reference signal through circuit 8-KA7 (WH/VT). When the multifunction switch wash button is pressed for longer than 0.25 second, the windshield wiper motor cycles, sending battery voltage through circuit 75S-KA7 (YE/VT) to the washer pump motor. When the wash button is pressed for less than 0.25 second the windshield wiper motor cycles only once, which is considered the mist position.

Possible Causes

- circuit 8-KA7 (WH/VT) open
- circuit 31-KA19 (BK/RD) open
- multifunction switch
- washer pump relay
- washer pump motor

PINPOINT TEST E: THE WASH AND WIPE FUNCTIONS ARE INOPERATIVE

Test Step	Result / Action to Take
E1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the multifunction switch pass the component test?**	**Yes** GO to E2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
E2 CHECK CIRCUIT 31-KA19 (BK/RD) FOR AN OPEN	
• Measure the resistance between the multifunction switch C202-2, circuit 31-KA19 (BK/RD), harness side and ground.	**Yes** GO to E3 . **No** REPAIR the circuit. TEST the system for normal operation.

 A0060291 • **Is the resistance less than 5 ohms?**	
E3 CHECK CIRCUIT 8-KA7 (WH/VT) FOR AN OPEN	
• Disconnect: Windshield Wiper Motor C125. • Measure the resistance between the multifunction switch C202-5, circuit 8-KA7 (WH/VT), harness side and the windshield wiper motor C125-12, circuit 8-KA7 (WH/VT), harness side.  A0060293 • **Is the resistance less than 5 ohms?**	**Yes** GO to Pinpoint Test F to diagnose the washer pump. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test F: The Washer Pump Is Inoperative

Normal Operation

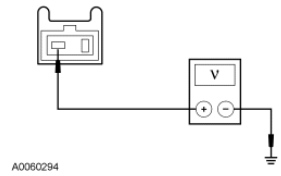
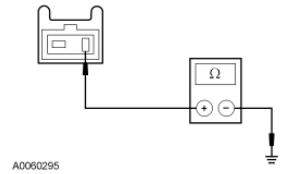
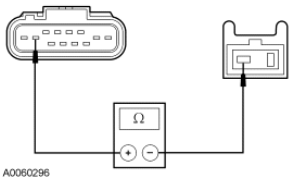
The multifunction switch sends a reference signal through circuit 8-KA7 (WH/VT) to the windshield wiper motor module (internal). The windshield wiper motor in turn sends battery voltage through circuit 75S-KA7 (YE/VT) to activate the washer pump motor.

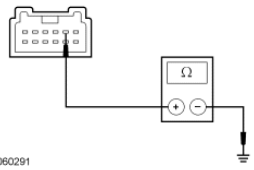
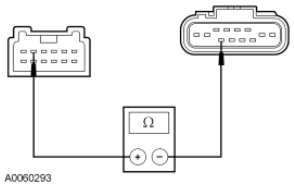
Possible Causes

- circuit 8-KA7 (WH/VT) open
- circuit 31-KA7 (BK//WH) open
- circuit 31-KA19 (BK/RD) open
- circuit 75S-KA7 (YE/VT) open
- windshield wiper motor
- multifunction switch
- washer pump motor

PINPOINT TEST F: THE WASHER PUMP IS INOPERATIVE

Test Step	Result / Action to Take
F1 CHECK THE WASHER PUMP MOTOR FOR VOLTAGE	
• Ignition OFF. • Disconnect: Washer Pump Motor C137. • Ignition ON.	**Yes** GO to F2 . **No** GO to F3 .

• Measure the voltage between the washer pump motor C137-2, circuit 75S-KA7 (YE/VT) harness side and ground while pressing the multifunction switch to the wash position.  A0060294 • **Is the voltage greater than 10 volts?**	
F2 CHECK CIRCUIT 31-KA7 (BK/WH) FOR GROUND	
• Measure the resistance between the washer pump motor C137-1, circuit 31-KA7 (BK/WH) harness side and ground.  A0060295 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new washer pump. REFER to Windshield Washer Pump and Reservoir in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
F3 CHECK CIRCUIT 75S-KA7 (YE/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125. • Measure the resistance between the windshield wiper motor C125-7, circuit 75S-KA7 (YE/VT), harness side and the washer pump motor C137-2, circuit 75S-KA7 (YE/VT), harness side.  A0060296 • **Is the resistance less than 5 ohms?**	**Yes** GO to F4 . **No** REPAIR the circuit. TEST the system for normal operation.
F4 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test.	**Yes** GO to F5 . **No** INSTALL a new multifunction switch.

Refer to Wiring Diagrams Cell 149 for component testing. • **Does the multifunction switch pass the component test?**	REFER to Section 211-05 . TEST the system for normal operation.
F5 CHECK CIRCUIT 31-KA19 (BK/RD) FOR AN OPEN	
• Measure the resistance between the multifunction switch C202-2, circuit 31-KA19 (BK/RD), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to F6 . **No** REPAIR the circuit. TEST the system for normal operation.
F6 CHECK CIRCUIT 8-KA7 (WH/VT) FOR AN OPEN	
• Measure the resistance between the multifunction switch C202-5, circuit 8-KA7 (WH/VT), harness side and the windshield wiper motor C125-12, circuit 8-KA7 (WH/VT), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to F7 . **No** REPAIR the circuit. TEST the system for normal operation.
F7 CHECK FOR CORRECT WINDSHIELD WIPER MOTOR OPERATION	

• Disconnect all the windshield wiper motor connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the windshield wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to F8 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

F8 CHECK THE WINDSHIELD WIPER MOTOR	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125.	**Yes** The system is operating correctly at this time. The concern may have been caused by

• Carry out the windshield wiper motor component test as described in this section. • **Does the windshield wiper motor pass the component test?**	binding or an incorrect pivot arm adjustment. REFER to Windshield Wiper Blade and Pivot Arm Adjustment in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Windshield Wiper Motor in this section. TEST the system for normal operation.

Pinpoint Test G: The Headlamps Do Not Illuminate When The Wipers Are On

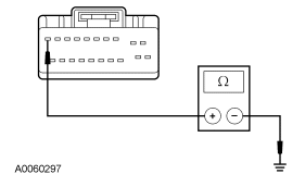
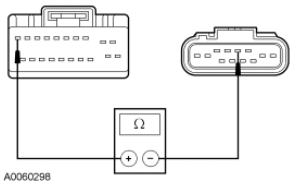
Normal Operation

The windshield wipers are activated by a ground signal sent from the wiper motor through circuit 8-KA5 (WH/BK) to the front electronic module (FEM). After 10 seconds of a continuous ground signal from the wiper motor on circuit 8-KA5 (WH/BK), the FEM illuminates the headlamps.

Possible Causes
- circuit 8-KA5 (WH/BK) open
- FEM
- windshield wiper motor

PINPOINT TEST G: THE HEADLAMPS DO NOT ILLUMINATE WHEN THE WIPERS ARE ON

Test Step	Result / Action to Take
G1 CHECK THE HEADLAMPS FOR NORMAL OPERATION	
• Turn the headlamp switch to the ON position. • **Do the headlamps illuminate?**	**Yes** GO to G2 . **No** REFER to Section 417-01 to correctly diagnose the headlamps.
G2 CHECK CIRCUIT 8-KA5 (WH/BK) FOR A GROUND SIGNAL	
• Disconnect: FEM C201f. • Ignition ON. • Turn the multifunction switch to the LO position • **NOTE:** Wait a minimum of 10 seconds before performing this step. • Measure the resistance between the FEM C201f-10, circuit 8-KA5 (WH/BK), harness side and ground.	**Yes** GO to G4 . **No** GO to G3 .

 A0060297 • **Is the resistance less than 5 ohms?**	
G3 CHECK CIRCUIT 8-KA5 (WH/BK) FOR AN OPEN	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125. • Measure the resistance between the FEM C201f-10, circuit 8-KA5 (WH/BK), harness side and the windshield wiper motor C125-2, circuit 8-KA5 (WH/BK), harness side.  A0060298 • **Is the resistance less than 5 ohms?**	**Yes** GO to G5 . **No** REPAIR the circuit. TEST the system for normal operation.
G4 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

G5 CHECK FOR CORRECT WINDSHIELD WIPER MOTOR OPERATION	

• Disconnect all the windshield wiper motor connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the windshield wiper motor connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	GO to G6 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

G6 CHECK THE WINDSHIELD WIPER MOTOR	
• Ignition OFF.	**Yes** The system is operating correctly at this time.

• Disconnect: Windshield Wiper Motor C125. • Carry out the windshield wiper motor component test as described in this section. • **Does the windshield wiper motor pass the component test?**	The concern may have been caused by a binding or an incorrect pivot arm adjustment. REFER to Windshield Wiper Blade and Pivot Arm Adjustment in this section. TEST the system for normal operation. **No** INSTALL a new windshield wiper motor. REFER to Windshield Wiper Motor in this section. TEST the system for normal operation.

Component Test — Windshield Wiper Motor

⚠ **CAUTION: Do not handle the windshield wiper motor roughly when diagnosing the wiper operations. Failure to follow these instructions may result in damage to the motor magnets and may render the windshield wiper motor inoperative. Rough handling of new windshield wiper motors may also damage the motor magnets.**

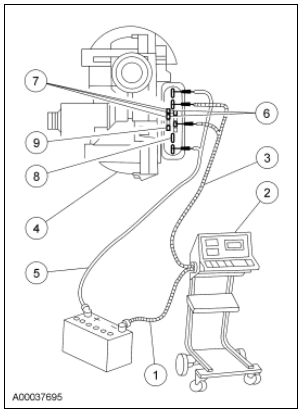
NOTE: The windshield wiper motor component test is carried out to determine if the windshield wiper motor and module are functional and not in a software safe mode. Refer to Principles of Operation in this section for software safe mode parameters.

NOTE: Battery voltage must remain within 10 to 15 volts to carry out the test and keep the windshield wiper motor from entering its software safe mode.

NOTE: When connecting the power and ground test leads to the windshield wiper motor terminals, care must be taken to not short the terminals between power and ground, as well as making sure the logic ground, pin 3, is always securely connected to prevent permanent windshield wiper motor module damage.

If the windshield wiper motor does not pass any of the following tests, install a new windshield wiper motor. Refer to Windshield Wiper Motor in this section.

Use the SABRE Premium Battery and Electrical System Tester to test the windshield wiper motor.



To test the windshield wiper motor, remove the windshield wiper mounting arm and pivot shaft from the windshield wiper motor. Refer to Windshield Wiper Motor in this section.

Disconnect the wiper motor. Connect the (1) green lead from the (2) SABRE to the battery negative (-) post. Connect the red lead (3) from the SABRE to the wiper motor (4) component side connector ground and logic ground pins 6 and 3 (3). Connect the battery positive cable (5) to the windshield wiper motor (4) component side connector battery and logic positive pins 5 and 8 (5).

Low Speed

Test the low speed mode by connecting a separate set of test leads from the battery ground (-) post to the windshield wiper motor (4) component side pins 9 and 10 (6). When these pins are grounded, the windshield wiper motor operation should now be in low speed mode.

High Speed

Test the high speed mode by connecting a separate set of test leads from the battery ground (-) post to windshield wiper motor (4) component side pins 1, 9, and 10 (7). When these pins are grounded, the windshield wiper motor operation should now be in high speed mode.

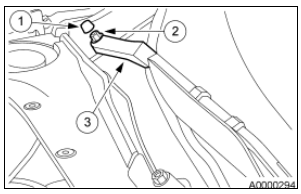
Washer Pump Relay (Integral)

Test the windshield wiper motor internal washer relay function by measuring the voltage between the windshield wiper motor (4) component side pin 7 (8), and ground while grounding the windshield wiper motor (4) component side pin 12 (9). When wash command input pin 12 is grounded, measured voltage should read 10 volts or greater.

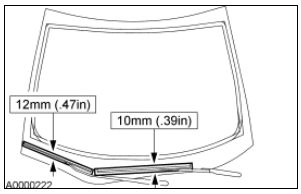
Windshield Wiper Blade and Pivot Arm Adjustment

1. Cycle and park the windshield wipers.

2. Remove the windshield wiper pivot arm(s).
    1. Remove the nut cover(s).
    2. Remove the nut(s).
    3. Remove the pivot arm(s).

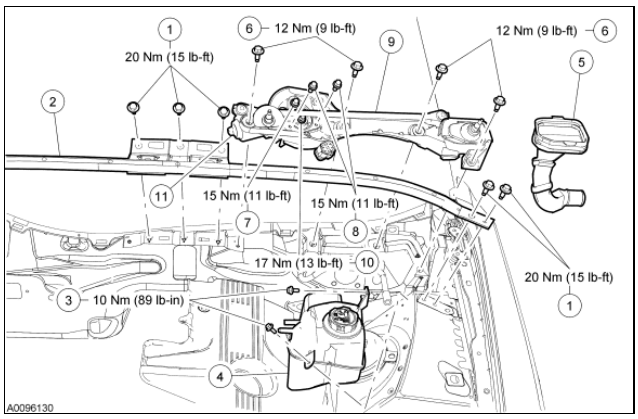


3. Install the wiper blade and pivot arm onto the pivot shaft and align the blade to the silver dots in the windshield.



4. Tighten the windshield wiper pivot arm nut(s).
    - Tighten to 25 Nm (18 lb-ft).
    - Install the pivot arm nut cover(s).

Wiper and Washer System — Exploded View



Item	Part Number	Description
1	N811389	Strut tower support brace bolts (7 required)
2	3B336	Strut tower support brace
3	W705968	Degas bottle bolts (2 required)
4	8A080	Degas bottle
5	—	Drain boot (part of 17508)
6	—	Mounting arm and pivot shaft assembly bolts (5 required)
7	—	Windshield wiper motor bolt
8	—	Windshield wiper motor bolts (2 required)
9	17508	Mounting arm and pivot shaft assembly
10	—	Windshield wiper motor crank bolt
11	17508	Windshield wiper motor assembly

1. For additional information, refer to the procedures in this section.

Wiper Mounting Arm and Pivot Shaft

Removal and Installation

1. ⚠ **CAUTION: The windshield wiper system has an auto park feature. It is necessary to disconnect the battery.**

   Disconnect the battery. For additional information, refer to Section 414-01 .

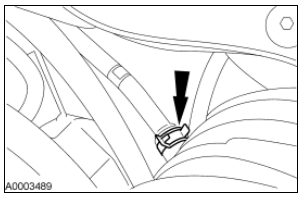
2. Partially drain the engine cooling system. For additional information, refer to Section 303-03 .

3. Remove the cowl panel grille. For additional information, refer to Section 501-02 .

4. Remove the 7 bolts and the strut tower support brace.
   - To install, tighten to 20 Nm (15 lb-ft).

5. Remove the 2 degas bottle bolts.
   - To install, tighten to 10 Nm (89 lb-in).

6. Disconnect the degas return hose from the degas return tube.



7. **NOTE:** When positioning the degas bottle aside, it is necessary to reroute the degas bottle lower hose in front of the brake booster.

   Position the degas bottle aside.

8. Remove the 5 bolts and the mounting arm and pivot shaft assembly.
   - To install, tighten to 12 Nm (9 lb-ft).

9. Position the windshield wiper mounting arm and pivot shaft assembly aside, and loosen the upper windshield wiper motor bolt.
   - To install, tighten to 15 Nm (11 lb-ft).

10. Disconnect the electrical connector and remove the mounting arm and pivot shaft assembly.

11. To install, reverse the removal procedure.

Windshield Wiper Motor

Removal and Installation

1. Remove the wiper mounting arm and pivot shaft. For additional information, refer to Wiper Mounting Arm and Pivot Shaft in this section.

2. Rotate the wiper output arm to the 6 o'clock position.

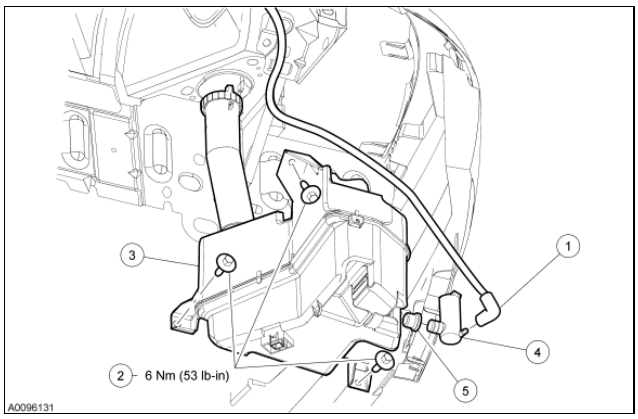
3. **NOTE:** To remove the lower wiper motor bolts, it is necessary to rotate the bottom of the windshield wiper mounting arm and pivot shaft assembly upward.

   Remove the 2 lower bolts and the windshield wiper motor.

   - To install, tighten to 15 Nm (11 lb-ft).

4. To install, reverse the removal procedure.

Windshield Washer Pump and Reservoir



Item	Part Number	Description
1	17A605	Windshield washer hose
2	W705641	Windshield washer reservoir screws (3 required)
3	17618	Windshield washer reservoir
4	17664	Windshield washer motor and pump assembly
5	17B610	Pump seal

Removal and Installation

1. ⚠ **CAUTION: Do not make electrical connections prior to filling the windshield washer reservoir. Do not operate the windshield washer pump prior to filling the windshield washer reservoir.**

   Disconnect the battery. For additional information, refer to Section 414-01 .

2. Position the right-front splash shield aside. For additional information, refer to Section 501-02 .

3. Disconnect the windshield washer hose and collect the windshield washer fluid in a container.

4. Remove the 3 screws and the windshield washer reservoir.
   - To install, tighten to 6 Nm (53 lb-in).

5. Disconnect the electrical connector and remove the washer motor and pump assembly.

6. To install, reverse the removal procedure.

General Specifications

Item	Specification
Roof opening panel glass flushness: front	-1.0 mm (-0.04 in)
Roof opening panel glass flushness: rear	1.0 mm (0.04 in)

Torque Specifications

Description	Nm	lb-in
Roof opening panel frame bolts	10	89
Roof opening panel glass screws	4	35
Roof opening panel motor screws	3	27

Roof Opening Panel

The roof opening panel is an electronically operated panel that is opened, closed or vented (tilted) by the roof opening panel switch. The switch has 2 detents for opening, 2 detents for closing and a center position for venting operations. Manual open and close are provided by the motor as long as the switch is held in the first detent. Express open or express close occurs if the switch is moved to the second detent, at which time it is released. Proportional tilt-up occurs when the vent/tilt switch is pressed while the roof opening panel is in the fully closed or tilt range. Proportional tilt-up stops when the vent/tilt switch is released. One-touch tilt occurs when the vent/tilt switch is pressed and released while the roof opening panel is in fully open or slide. When commanded, the roof opening panel express closes then moves to the full vent position.

Roof Opening Panel

Refer to Wiring Diagrams Cell 101 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

The roof opening panel assembly uses an integrated motor and module to operate the roof opening panel. The roof opening panel motor and module are installed new as an assembly. The roof opening panel is an electronically operated glass panel that can be opened, closed or tilted by the roof opening panel switch. Actuating the switch in either a forward or rearward motion supplies a ground to the roof opening panel motor/module. The roof opening panel has an express open feature that is activated when the switch is momentarily pressed to the double detent open position. This function is controlled by the roof opening panel motor/module.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Roof opening panel glass • Roof opening panel • Roof opening panel drain hoses • Roof opening panel lifter assemblies • Roof opening panel water trough • Roof opening panel weatherstrip	• Rear battery junction box (BJB) fuse 16 (20A) • Circuitry • Driver door module (DDM) • Loose or corroded connections • Roof opening panel motor • Roof opening panel control switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. Any disassembly of the roof opening panel requires motor initialization. Refer to Roof Opening Panel Motor Initialization in this section.

5. If the concern is not visually evident, verify the symptom and GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Roof Opening Panel Has Excessive Wind Noise

Normal Operation

When the roof opening panel glass is completely closed, it should be flush with the roof panel.

Possible Causes
- roof opening panel adjustment
- roof opening panel weatherstrip

PINPOINT TEST A: THE ROOF OPENING PANEL HAS EXCESSIVE WIND NOISE

Test Step	Result / Action to Take
A1 CHECK THE ROOF OPENING PANEL SEALS	
• **NOTE:** Make sure the weatherstrip is not loose, cracked, pinched or obstructed. • Check the roof opening panel weatherstrip. • **Is the weatherstrip OK?**	**Yes** GO to A2 . **No** INSTALL a new roof opening panel weatherstrip. REFER to Roof Opening Panel Weatherstrip in this section. INITIALIZE the roof opening panel. REFER to Roof Opening Panel Motor Initialization in this section.
A2 CHECK THE ROOF OPENING PANEL ADJUSTMENT	
• Ignition ON. • Open and close the roof opening panel glass. • Check the adjustment when the roof opening	**Yes** CHECK for correct installation of the roof opening panel motor. REFER to Roof Opening Panel Motor in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

panel glass closes. • **Is the adjustment OK?**	**No** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test B: The Roof Opening Panel Leaks

Normal Operation

When the roof opening panel glass is completely closed, it should be flush with the roof panel.

Possible Causes
- roof opening panel adjustment
- roof opening panel drain hose(s)
- roof opening panel weatherstrip
- roof opening panel
- roof opening panel frame

PINPOINT TEST B: THE ROOF OPENING PANEL LEAKS

Test Step	Result / Action to Take
B1 CHECK THE ROOF OPENING PANEL OPERATION	
• Cycle the roof opening panel glass from the full-open position to the full-closed position. • Check the roof opening panel glass adjustment. REFER to Roof Opening Panel Alignment in this section. • **Does the roof opening panel glass operate smoothly, close tightly and meet general adjustment specifications?**	**Yes** GO to B2 . **No** ADJUST the roof opening panel. REFER to Roof Opening Panel Alignment in this section.
B2 CHECK THE ROOF OPENING PANEL WEATHERSTRIP	
• Actuate the roof opening panel glass to the full-open position. • **NOTE:** The weatherstrip has a bonded butt joint located on the passenger side or rear edge. This is not a defect. • Inspect the roof opening panel weatherstrip for cuts, tears, gouges and creases. • **Is the roof opening panel weatherstrip damaged?**	**Yes** INSTALL a new roof opening panel weatherstrip. REFER to Roof Opening Panel Weatherstrip in this section. **No** GO to B3 .
B3 CHECK THE ROOF OPENING PANEL REAR TROUGH AND TROUGH GUIDES	
• **NOTE:** The rear trough should travel back and forth smoothly with the roof opening panel	**Yes** GO to B4 .

glass. • Check the rear trough and trough guides for proper attachment and function. • **Does the rear trough operate correctly?**	**No** INSTALL a new roof opening panel trough assembly. REFER to Trough Assembly in this section.
B4 CHECK THE ROOF OPENING PANEL DRAIN TUBES	
• **NOTE:** Drain hoses can be viewed with a flashlight by removing the headliner lace around the inside opening and **gently** pulling down on the headliner. • **NOTE:** On some vehicles the trim lace has been replaced by Velcro® style attachments. • Gain access to the roof opening panel frame drain tubes. • **Are the drain tubes correctly positioned and properly attached.**	**Yes** GO to B5 . **No** ADJUST or ATTACH the drain tube(s). GO to B5 .
B5 CHECK THE ROOF OPENING PANEL DRAIN TUBES FLOW	
NOTE: Drain hoses must flow downhill and can not be pinched or restricted by the headliner or any other trim components. • Open the roof opening panel. • **Slowly** pour water into the trough area and make sure that the same amount of water exits the vehicle at the bottom of the A and C pillars. • **Does the water properly drain through each of the drain tubes?**	**Yes** TAPE off the roof opening panel and INSPECT other areas of the vehicle that may cause water leaks to enter the roof area. **No** CLEAR obstruction(s) with compressed air. REPEAT test. If obstruction is not clear, LOWER the headliner and INSPECT drain tube(s) for correct routing, pinches or restrictions. REPAIR as necessary.

Pinpoint Test C: The Roof Opening Panel Rattles

Normal Operation

When the roof opening panel glass is completely closed, it should be flush with the roof panel. All components should be secured correctly.

Possible Causes

- roof opening panel
- roof opening panel tracks
- roof opening panel water trough
- roof opening panel lifter assemblies
- headliner
- roof opening panel motor pad
- roof opening panel bolts
- roof opening panel frame

PINPOINT TEST C: THE ROOF OPENING PANEL RATTLES

Test Step	Result / Action to Take
C1 CHECK THE ROOF OPENING PANEL OPERATION	
• Check the roof opening panel during operation. • **Is the roof opening panel loose?**	**Yes** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** GO to C2 .
C2 CHECK THE ROOF OPENING PANEL TRACKS	
• Open the roof opening panel. • Check the roof opening panel tracks for obstructions and damage. • **Are the roof opening panel tracks OK?**	**Yes** GO to C3 . **No** REMOVE all the roof opening panel track obstructions and REPAIR the roof opening panel tracks. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
C3 CHECK THE ROOF OPENING PANEL WATER TROUGH AND TROUGH GUIDES	
• Check the roof opening panel water trough and trough guides for any loose fasteners or obstructions. • **Are the roof opening panel trough and trough guides installed securely and free from obstructions?**	**Yes** GO to C4 . **No** REMOVE all obstructions from the roof opening panel trough and INSTALL securely. SECURE the trough guides or INSTALL a new roof opening panel frame if damaged. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
C4 CHECK THE ROOF OPENING PANEL MOTOR PAD	
• Check the motor pad for correct installation and damage. • **Is the motor pad installed correctly and not damaged?**	**Yes** GO to C5 . **No** INSTALL the motor pad correctly or INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. TEST the system for normal operation.
C5 CHECK THE ROOF OPENING PANEL AIR DEFLECTOR ASSEMBLY	
• Check the roof opening panel air deflector for obstructions	**Yes** GO to C6 .

and damage. • **Is the roof opening panel air deflector OK?**	**No** REMOVE all obstructions and REPAIR as necessary. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
C6 CHECK THE ROOF OPENING PANEL	
• Verify the roof opening panel is free from obstruction and damage, and is securely fastened. • **Is the roof opening panel assembly OK?**	**Yes** GO to C7 . **No** REPAIR or INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
C7 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES	
• Verify the roof opening panel lifter assemblies are free from obstructions and damage. • **Are the roof opening panel lifter assemblies OK?**	**Yes** INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. INITIALIZE the roof opening panel. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** REMOVE all obstructions from the roof opening panel lifter assemblies and REPAIR any damage. TEST the system for normal operation.

Pinpoint Test D: The Roof Opening Panel Is Noisy During Operation

Normal Operation

The roof opening panel should operate smoothly while opening and closing.

Possible Causes
- roof opening panel
- roof opening panel lifter assemblies
- roof opening panel adjustment
- roof opening panel motor

PINPOINT TEST D: THE ROOF OPENING PANEL IS NOISY DURING OPERATION

Test Step	Result / Action to Take
D1 CHECK THE ROOF OPENING PANEL FOR OBSTRUCTIONS OR DAMAGE	

• Check the roof opening panel for any obstructions and damage. • **Are there any obstructions or damage?**	**Yes** REMOVE all obstructions. REPAIR any damage or INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** GO to D2 .
D2 CHECK THE ROOF OPENING PANEL OPERATION	
• Check the roof opening panel during operation. • **Is the roof opening panel loose or incorrectly adjusted?**	**Yes** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** GO to D3 .
D3 CHECK THE ROOF OPENING PANEL TRACKS	
• Open the roof opening panel. • Check the roof opening panel tracks for obstructions and damage. • **Are the roof opening panel tracks OK?**	**Yes** GO to D4 . **No** REMOVE all obstructions and REPAIR any damage. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
D4 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES	
• Check the roof opening panel lifter assemblies for obstructions and damage. • **Are the roof opening panel lifter assemblies OK?**	**Yes** GO to D5 . **No** REMOVE all obstructions and REPAIR any damage. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
D5 CHECK THE ROOF OPENING PANEL MOTOR	
• Gain access to the roof opening panel motor. • Open the roof opening panel. • **Does the roof opening panel motor make excessive noise?**	**Yes** INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section.

	TEST the system for normal operation.

Pinpoint Test E: The Roof Opening Panel Is Inoperative

Normal Operation

The rear battery junction box (BJB) supplies voltage to the roof opening panel motor through circuit 30-AG12 (RD/GN). The roof opening panel motor is grounded through circuit 31-AG12 (BK/GN). When the roof opening panel control switch is operated it connects the circuits for tilt up, open, or close to circuit 9-AG7 (BN/RD). Delayed accessory power is supplied by the driver door module (DDM) through circuit 10-AJ43B (GY/VT).

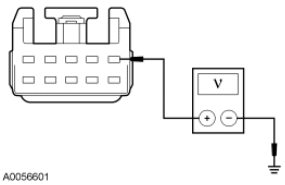
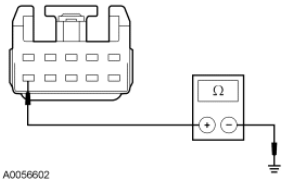
Possible Causes

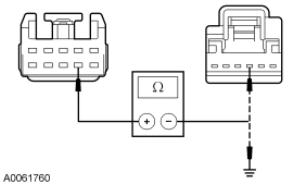
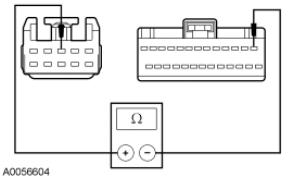
- fuse
- circuit 9-AG7 (BN/RD) short to ground or open
- circuit 10-AJ43B (GY/VT) open
- circuit 30-AG12 (RD/GN) open
- circuit 31-AG12 (BK/GN) open
- roof opening panel control switch
- roof opening panel lifter assemblies
- roof opening panel adjustment
- roof opening panel motor

PINPOINT TEST E: THE ROOF OPENING PANEL IS INOPERATIVE

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
E1 VERIFY THE POWER WINDOWS OPERATE	
• Operate the power windows. • **Do the power windows operate?**	**Yes** GO to E2 . **No** REFER to Section 501-11 to diagnose the power windows.
E2 VERIFY THE ROOF OPENING PANEL ALIGNMENT	
• Verify the roof opening panel is aligned correctly. • **Is the roof opening panel aligned correctly?**	**Yes** GO to E3 . **No** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

E3 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES FOR OBSTRUCTIONS AND DAMAGE	
• Check the roof opening panel lifter assemblies for obstructions and damage. • **Are the roof opening panel lifter assemblies OK?**	**Yes** GO to E4 . **No** REMOVE all obstructions and REPAIR any damage. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
E4 CHECK CIRCUIT 30-AG12 (RD/GN) FOR VOLTAGE	
• Disconnect: Roof Opening Panel Motor C920. • Measure the voltage between the roof opening panel motor C920-1, circuit 30-AG12 (RD/GN), harness side and ground.  A0056601 • **Is the voltage greater than 10 volts?**	**Yes** GO to E5 . **No** VERIFY the rear BJB fuse 16 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
E5 CHECK CIRCUIT 31-AG12 (BK/GN) FOR AN OPEN	
• Measure the resistance between the roof opening panel motor C920-10, circuit 31-AG12 (BK/GN), harness side and ground.  A0056602 • **Is the resistance less than 5 ohms?**	**Yes** GO to E6 . **No** REPAIR the circuit. TEST the system for normal operation.
E6 CHECK THE ROOF OPENING PANEL CONTROL SWITCH	
• Disconnect: Roof Opening Panel Control Switch C912. • Carry out the roof opening panel control switch component test. Refer to Component Test in this section. • **Is the roof opening panel control switch OK?**	**Yes** GO to E7 . **No** INSTALL a new roof opening panel control switch. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor

	Initialization in this section. TEST the system for normal operation.
E7 CHECK CIRCUIT 9-AG7 (BN/RD) FOR A SHORT TO GROUND OR AN OPEN	
• Measure the resistance between the roof opening panel motor C920-7, circuit 9-AG7 (BN/RD), harness side and ground; and between the roof opening panel motor C920-7, circuit 9-AG7 (BN/RD), harness side and the roof opening panel control switch C912-3, circuit 9-AG7 (BN/RD), harness side.  • **Is the resistance greater than 10,000 ohms between the roof opening panel motor and ground, and less than 5 ohms between the roof opening panel control switch and the roof opening panel motor?**	**Yes** GO to E8 . **No** REPAIR the circuit. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
E8 CHECK CIRCUIT 10-AJ43B (GY/VT) FOR AN OPEN	
• Disconnect: DDM C501d. • Measure the resistance between the roof opening panel motor C920-3, circuit 10-AJ43B (GY/VT), harness side and the DDM C501d-1, circuit 10-AJ43B (GY/VT), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** REPAIR the circuit. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test F: The Roof Opening Panel Does Not Open Or Close

Normal Operation

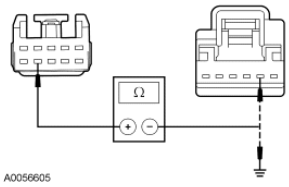
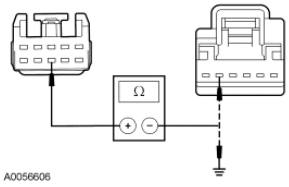
The rear battery junction box (BJB) supplies voltage to the roof opening panel motor. When the roof opening panel control switch is moved to the open position and released it connects circuit 32-AG10 (WH/BU) for open. When the roof opening panel control switch is moved to the close position and released it connects circuit 33-AG10 (YE/BU) for close.

Possible Causes

- circuit 32-AG10 (WH/BU) short to ground or open
- circuit 33-AG10 (YE/BU) short to ground or open
- roof opening panel control switch
- roof opening panel lifter assemblies
- roof opening panel adjustment
- roof opening panel motor

PINPOINT TEST F: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE

Test Step	Result / Action to Take
F1 VERIFY THE ROOF OPENING PANEL ADJUSTMENT	
• Verify the roof opening panel is adjusted correctly. • **Is the roof opening panel adjusted correctly?**	**Yes** GO to F2 . **No** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
F2 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES FOR OBSTRUCTIONS AND DAMAGE	
• Check the roof opening panel lifter assemblies for obstructions and damage. • **Are the roof opening panel lifter assemblies OK?**	**Yes** GO to F3 . **No** REMOVE all obstructions and REPAIR any damage. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
F3 CHECK THE ROOF OPENING PANEL CONTROL SWITCH	
• Ignition OFF. • Disconnect: Roof Opening Panel Control Switch C912. • Carry out the roof opening panel control switch component test. Refer to Component Test in this section. • **Is the roof opening panel control switch OK?**	**Yes** If the open function is inoperative, GO to F4 . If the close function is inoperative, GO to F5 . **No** INSTALL a new roof opening panel control switch. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

F4 CHECK CIRCUIT 32-AG10 (WH/BU) FOR A SHORT TO GROUND OR AN OPEN	
• Disconnect: Roof Opening Panel Motor C920. • Measure the resistance between the roof opening panel motor C920-9, circuit 32-AG10 (WH/BU), harness side and ground; and between the roof opening panel motor C920-9, circuit 32-AG10 (WH/BU), harness side and the roof opening panel control switch C912-2, circuit 32-AG10 (WH/BU), harness side.  A0056605 • **Is the resistance greater than 10,000 ohms between the roof opening panel motor and ground, and less than 5 ohms between the roof opening panel control switch and the roof opening panel motor?**	**Yes** INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** REPAIR the circuit. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
F5 CHECK CIRCUIT 33-AG10 (YE/BU) FOR A SHORT TO GROUND OR AN OPEN	
• Disconnect: Roof Opening Panel Motor C920. • Measure the resistance between the roof opening panel motor C920-8, circuit 33-AG10 (YE/BU), harness side and ground; and between the roof opening panel motor C920-8, circuit 33-AG10 (YE/BU), harness side and the roof opening panel control switch C912-5, circuit 33-AG10 (YE/BU), harness side.  A0056606 • **Is the resistance greater than 10,000 ohms between the roof opening panel motor and ground, and less than 5 ohms between the roof opening panel control switch and the roof opening panel motor?**	**Yes** INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** REPAIR the circuit. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test G: The Roof Opening Panel Does Not Open Or Close In Vent Position

Normal Operation

The roof opening panel motor is supplied voltage by the rear battery junction box (BJB). When the roof opening panel control switch is pressed it connects circuit 32-AG12 (WH/GN) for tilt up. When the roof opening panel control switch is moved to the close position and released it connects circuit 33-AG10 (YE/BU)

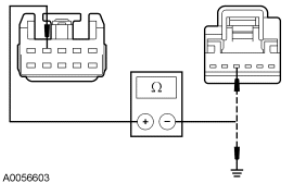
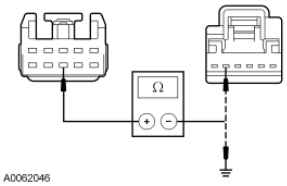
for close.

Possible Causes

- circuit 32-AG12 (WH/GN) short to ground or open
- circuit 33-AG10 (YE/BU) short to ground or open
- roof opening panel adjustment
- roof opening panel control switch
- roof opening panel lifter assemblies
- roof opening panel motor

PINPOINT TEST G: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE IN VENT POSITION

Test Step	Result / Action to Take
G1 VERIFY THE ROOF OPENING PANEL ADJUSTMENT	
• Verify the roof opening panel is adjusted correctly. • **Is the roof opening panel adjusted correctly?**	**Yes** GO to G2 . **No** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
G2 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES FOR OBSTRUCTIONS AND DAMAGE	
• Check the roof opening panel lifter assemblies for obstructions and damage. • **Are the roof opening panel lifter assemblies OK?**	**Yes** GO to G3 . **No** REMOVE all obstructions and REPAIR any damage. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
G3 CHECK THE ROOF OPENING PANEL CONTROL SWITCH	
• Ignition OFF. • Disconnect: Roof Opening Panel Control Switch C912. • Carry out the roof opening panel control switch component test. Refer to Component Test in this section. • **Is the roof opening panel control switch OK?**	**Yes** GO to G4 . **No** INSTALL a new roof opening panel control switch. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

G4 CHECK CIRCUIT 32-AG12 (WH/GN) FOR A SHORT TO GROUND OR AN OPEN	
• Disconnect: Roof Opening Panel Motor C920. • Measure the resistance between the roof opening panel motor C920-4, circuit 32-AG12 (WH/GN), harness side and ground; and between the roof opening panel motor C920-4, circuit 32-AG12 (WH/GN), harness side and the roof opening panel control switch C912-4, circuit 32-AG12 (WH/GN), harness side.  • **Is the resistance greater than 10,000 ohms between the roof opening panel motor and ground, and less than 5 ohms between the roof opening panel control switch and the roof opening panel motor?**	**Yes** GO to G5 . **No** REPAIR the circuit. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.
G5 CHECK CIRCUIT 33-AG10 (YE/BU) FOR A SHORT TO GROUND OR AN OPEN	
• Measure the resistance between the roof opening panel motor C920-8, circuit 33-AG10 (YE/BU), harness side and ground; and between the roof opening panel motor C920-8, circuit 33-AG10 (YE/BU), harness side and the roof opening panel control switch C912-5, circuit 33-AG10 (YE/BU), harness side.  • **Is the resistance greater than 10,000 ohms between the roof opening panel motor and ground, and less than 5 ohms between the roof opening panel motor and the roof opening panel control switch?**	**Yes** INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** REPAIR the circuit. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test H: The Global Open/Close Is Inoperative

Normal Operation

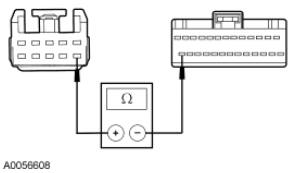
When the global open or close feature is activated the driver door module (DDM) sends a signal through circuit 8-AJ43B (WH/BU) to the roof opening panel motor. The global open/close does not function when the delayed accessory is active.

Possible Causes

- circuit 8-AJ43B (WH/BU) open
- roof opening panel motor

PINPOINT TEST H: THE GLOBAL OPEN/CLOSE IS INOPERATIVE

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
H1 VERIFY THE POWER WINDOWS ARE OPERATIONAL	
• Operate the power windows, using the global open/close procedure. • **Do the power windows operate correctly?**	**Yes** GO to H2 . **No** REFER to Section 501-11 to diagnose the inoperative windows.
H2 CHECK CIRCUIT 8-AJ43B (WH/BU) FOR AN OPEN	
• Disconnect: Roof Opening Panel Motor C920. • Disconnect: DDM C501d. • Measure the resistance between the roof opening panel motor C920-6, circuit 8-AJ43B (WH/BU), harness side and the DDM C501d-26, circuit 8-AJ43B (WH/BU), harness side.  A0056608 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** REPAIR the circuit. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

Pinpoint Test I: The Express Open/Close Is Inoperative

Normal Operation

When the roof opening panel control switch is placed in the second detent of the open position the roof opening panel opens automatically to the full-open position. When the roof opening panel control switch is placed in the second detent of the close position, the roof opening panel closes automatically to the full-close position.

Possible Causes

- roof opening panel control switch
- roof opening panel motor

PINPOINT TEST I: THE EXPRESS OPEN/CLOSE IS INOPERATIVE

Test Step	Result / Action to Take
I1 CHECK THE ROOF OPENING PANEL CONTROL SWITCH	
• Ignition OFF. • Disconnect: Roof Opening Panel Control Switch C912. • Carry out the roof opening panel control switch component test. Refer to Component Test in this section. • **Is the roof opening panel control switch OK?**	**Yes** INSTALL a new roof opening panel motor. REFER to Roof Opening Panel Motor in this section. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation. **No** INSTALL a new roof opening panel control switch. INITIALIZE the roof opening panel motor. REFER to Roof Opening Panel Motor Initialization in this section. TEST the system for normal operation.

Component Test

Roof Opening Panel Control Switch

1. Measure the resistance between the following roof opening panel control switch C912 pins (component side) as follows:

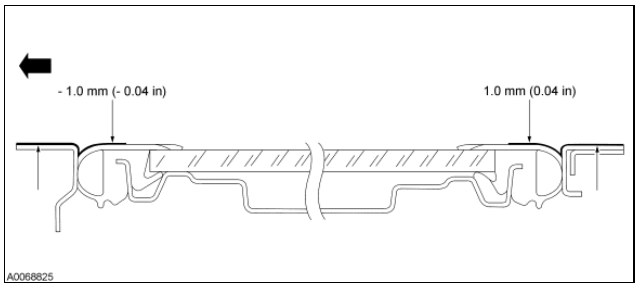
Switch Position	Pin	Resistance Value
Off	Between All Pins	Greater than 10,000 ohms
Tilt Up	3 and 4	Less than 5 ohms
Open	2 and 3	Less than 5 ohms
One Touch Open	2, 3 and 4	Less than 5 ohms
Close/Tilt Down	3 and 5	Less than 5 ohms
One Touch Close	2, 3 and 5	Less than 5 ohms

Roof Opening Panel Alignment

1. Cycle the roof opening panel glass through the fully-open to the fully-closed position.

2. Loosen the 4 roof opening panel glass screws.

3. Adjust the roof opening panel glass to specification.



4. Tighten the 4 roof opening panel glass screws.
   - Tighten to 4 Nm (35 lb-in).

5. Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

Roof Opening Panel Motor Initialization

NOTE: This procedure must be carried out when repairs (including lubrication) are performed on any part of the roof opening panel system.

Vehicles with roof opening panel and the glass in the slide range fore/aft

1. Turn the key to the ON position, then begin moving the glass panel using express open or express close.
2. While the glass panel is moving, press and hold the tilt switch for 10 seconds.
3. The glass stops as soon as the switch is pressed.
4. After 10 seconds, release the tilt switch. (Continue to step 8.)

Vehicles with roof opening panel and the glass in the closed or vent range

5. Press and hold the tilt switch.
6. The glass will move to full tilt position and stop, but do not release the tilt switch.
7. Continue holding the tilt switch for an additional 10 seconds. After 10 seconds, release the tilt switch. (Continue to step 8.)

Vehicles with new or existing roof opening panel and the glass in the slide, closed or vent range

8. Press and hold the tilt switch.
9. The glass panel is driven in the tilt up direction to the tilt up hard stop.
10. The drive recognizes a hard stop has occurred.
11. The drive reverses the glass panel to the normal tilt up soft stop position.
12. After the glass stops, release the tilt switch.
13. Within 5 seconds of releasing the tilt switch, press and hold the switch.
14. The drive moves through the full closed position to the full open position and back to full closed.
15. Test the express open and express close using the switch.

Water Drainage System Check and Water Leak Corrections

NOTE: One drain hose is attached at each corner of the roof panel. The 2 front drain hoses are routed down the windshield pillars and into the cowl sides exiting at the rocker panel drain holes. The 2 rear drain hoses are routed down the rear pillars, along the inside rear quarter panel and through the rear of the vehicle.

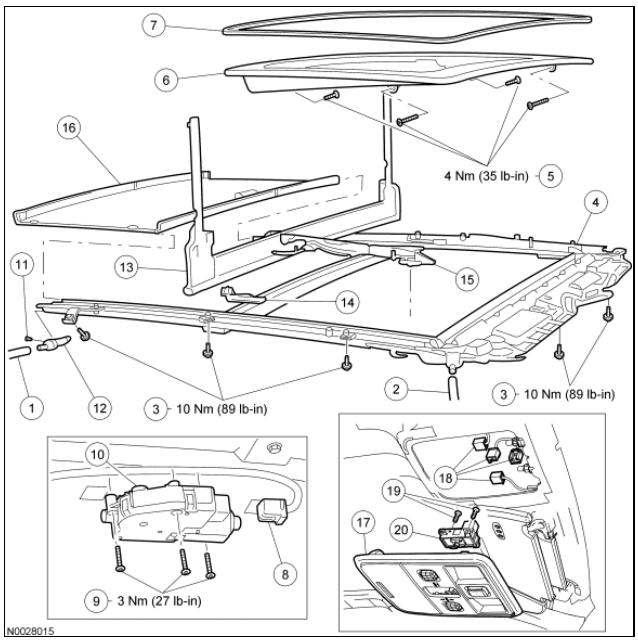
1. Pour water into the drain trough and inspect the front and rear of the vehicle to make sure the water drains from the rocker panels and rear quarter panels.

2. If the water flow is restricted, remove any material in the drain hose system. Test by pouring water slowly into the system.

3. Verify the roof opening panel weatherstrip is not damaged. If the weatherstrip is damaged, a new roof opening panel weatherstrip must be installed. For additional information, refer to Roof Opening Panel Weatherstrip in this section. Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

4. Check the roof opening panel alignment. For additional information, refer to Roof Opening Panel Alignment in this section. Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

Roof Opening Panel — Exploded View



Item	Part Number	Description
1	502C53	Rear drain hoses (2 required)
2	502C52	Front drain hoses (2 required)
3	—	Roof opening panel frame bolts (8 required) (part of 500B02 kit)
4	51070	Roof opening panel frame assembly
5	—	Roof opening panel glass screws (4 required) (part of 500B02 kit)
6	500A18	Roof opening panel glass
7	51884	Roof opening panel weatherstrip
8	—	Electrical connectors (part of 15C670 wiring harness)
9	—	Roof opening panel motor screws (3 required) (part of 15790)
10	15790	Roof opening panel motor
11	—	Roof opening panel frame drain valve screws (2 required) (part of 503A36)
12	503A36	Roof opening panel frame drain valves (2 required)
13	54022	Roof opening panel trough
14	—	Roof opening panel trough guides (part of 51070)
15	—	Lifter arms (part of 51070)
16	519A02	Roof opening panel shield
17	519A70	Overhead console
18	—	Overhead console electrical connectors (part of 14A464 wiring harness)

19	—	Roof opening panel switch screws (2 required) (part of 15B691)
20	15B691	Roof opening panel control switch

1. For additional information, refer to the procedures in this section.

Roof Opening Panel Glass

Removal

1. Operate the roof opening glass assembly to the closed position.
2. Remove the 4 roof opening panel glass screws.
3. From the exterior of the vehicle, lift the roof opening glass from the vehicle.

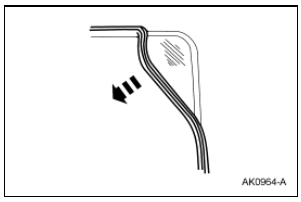
Installation

1. Install the roof opening panel glass and the 4 screws.
   - Tighten to 4 Nm (35 lb-in).
2. Align the roof opening glass. For additional information, refer to Roof Opening Panel Alignment in this section.

Roof Opening Panel Weatherstrip

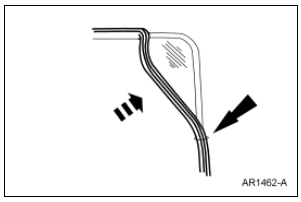
Removal

1. Remove the roof opening panel glass. Refer to Roof Opening Panel Glass in this section.
2. Remove the roof opening panel glass weatherstrip.



Installation

1. Place a new weatherstrip into position on the glass assembly, with the splice (seam) on the passenger side.



2. Starting with the corners, push the weatherstrip into position. Continue pushing the weatherstrip into position around the glass assembly until complete. Use a plastic hammer if necessary.
3. Install the roof opening panel glass. Refer to Roof Opening Panel Glass in this section.

Roof Opening Panel Motor

Removal and Installation

1. **NOTE:** Make sure the roof opening panel glass does not move during the motor removal or installation. The roof opening panel timing may be affected and cause the roof opening panel glass to bind.

   Remove the overhead console.

   - Disconnect the 4 electrical connectors.

2. Disconnect the roof opening panel motor electrical connector.

3. Remove the 3 screws and the roof opening panel motor.
   - To install, tighten to 3 Nm (27 lb-in).

4. **NOTE:** If the roof opening panel glass moved while the roof opening panel motor was removed, the roof opening panel motor must be initialized.

   To install, reverse the removal procedure.

   - If necessary, initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

Roof Opening Panel Frame

Removal

1. Remove the headliner. For additional information, refer to Section 501-05 .
2. Disconnect the 2 rear and the 2 front drain hoses.
3. Disconnect the roof opening panel motor electrical connector.
4. **NOTE:** Support the roof opening panel frame to prevent it from dropping.

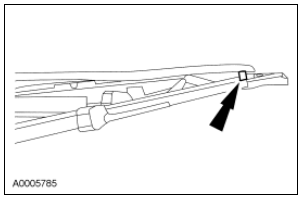
   Remove the 8 bolts and the roof opening panel frame.

Installation

1. **NOTE:** The roof opening panel frame is available separately or as an assembly with the roof opening panel shield and glass.

   If necessary, transfer the roof opening panel shield and glass components to the roof opening panel frame. For additional information, refer to Roof Opening Panel Shield in this section.

2. Position the roof opening panel frame to the vehicle and the 2 alignment pins.



3. Install the 8 roof opening panel frame bolts.
   - Tighten to 10 Nm (89 lb-in).
4. Connect the roof opening panel motor electrical connector.
5. Connect the 2 front and the 2 rear drain hoses.
6. Install the headliner. For additional information, refer to Section 501-05 .
7. Align the roof opening panel glass. For additional information, refer to Roof Opening Panel Alignment in this section.

Roof Opening Panel Shield

Removal and Installation

1. Remove the roof opening panel glass. For additional information, refer to Roof Opening Panel Glass .
2. Unsnap front of trough assembly from the mechanism.
3. Rotate the trough arms upward to allow shield to be pulled forward in front of the trough.
4. Pull the roof opening panel shield forward so the rear of the shield passed below and in front of the trough.
5. Remove the roof opening panel shield.
    - Lift the forward edge slightly.
    - Release the front and rear tabs from the roof opening panel frame tracks.
6. To install, reverse the removal procedure.

Trough Assembly

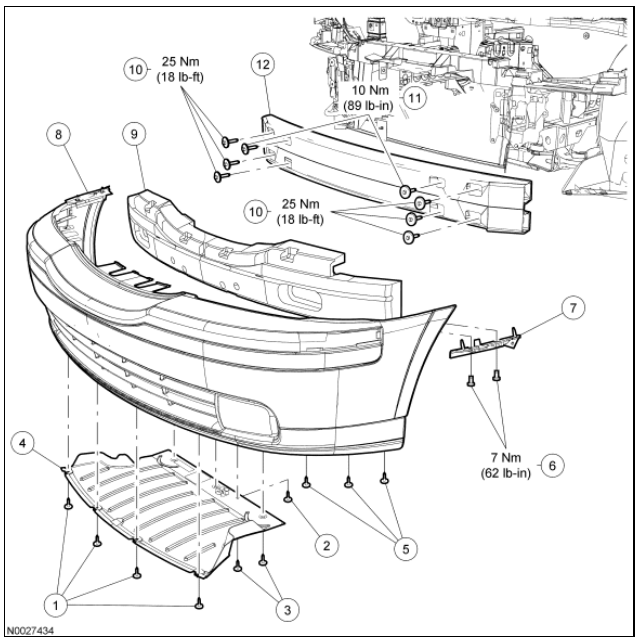
Removal and Installation

1. Remove the roof opening glass. For additional information, refer to Roof Opening Panel Glass in this section.
2. Remove the roof opening panel frame. For additional information, refer to Roof Opening Panel Frame in this section.
3. Unsnap the roof opening panel trough from the mechanism.
4. Rotate the trough upward 90° to disengage from the rear trough guides.
5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Exhaust bracket bolt	30	22	—
Front bumper cover bracket bolts	7	—	62
Front bumper bolts	10	—	89
Front bumper bolts	25	18	—
Rear bumper bolts	23	17	—
Rear bumper cover nuts	7	—	62
Rear bumper cover bolts	7	—	62

Bumper — Exploded View, Front



Item	Part Number	Description
1	N801169	Front valance panel screws (4 required)
2	389358	Front valance panel pin-type retainer
3	N801169	Front valance panel screws (3 required)
4	17626	Front valance panel
5	N606676	Lower fender splash shield screws (6 required)
6	W704273	Front bumper cover bracket bolts (4 required)
7	17E814	Front bumper cover brackets (2 required) (RH/LH)
8	17D957	Front bumper cover
9	17754	Front bumper isolator
10	N805737	Front bumper bolts (6 required)
11	N805737	Front bumper bolts (2 required)
12	17757	Front bumper

1. For additional information, refer to the procedures in this section.

Front Bumper Cover

Removal and Installation

1. Remove the headlamps. For additional information, refer to Section 417-01 .
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
3. Remove the 6 screws, the pin-type retainer, and the front valance panel.
4. Remove the 6 lower fender splash shield screws.
5. Disconnect the 2 fog lamp electrical connectors.
6. Remove the 4 front bumper cover bracket bolts from the fenders.
    - To install, tighten to 7 Nm (62 lb-in).
7. Pull the center tabs downward and the outboard tabs on each side outward and remove the front bumper cover.
8. To install, reverse the removal procedure.

Front Bumper

Removal and Installation

1. Remove the front bumper cover. For additional information, refer to Front Bumper Cover in this section.

2. Remove the front bumper isolator.

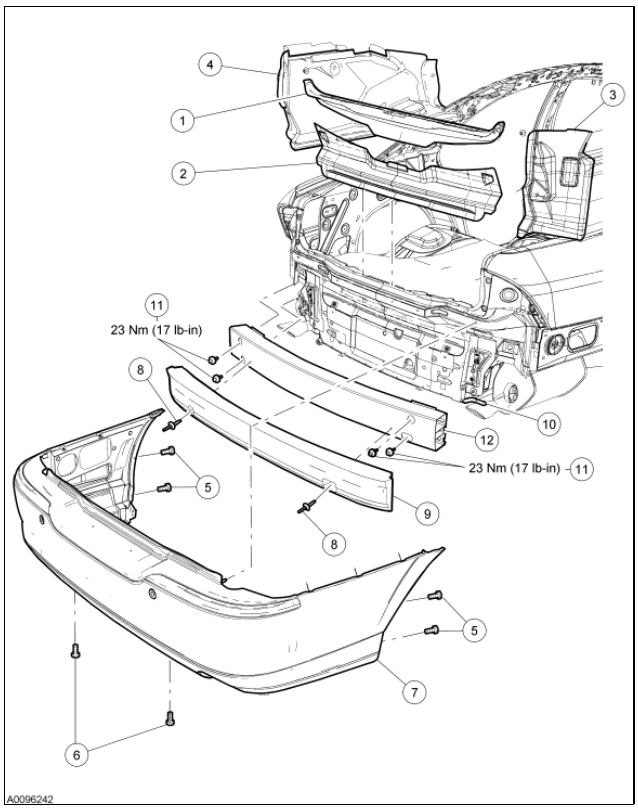
3. **NOTE:** Spot welding the bumper is not required for installation.

   Drill out the 6 front bumper spot welds.

4. Remove the 8 bolts and the front bumper.
   - To install, tighten the 6 front bumper bolts to 25 Nm (18 lb-ft).
   - To install, tighten the 2 front bumper bolts to 10 Nm (89 lb-ft).

5. To install, reverse the removal procedure.

Bumper — Exploded View, Rear



Item	Part Number	Description
1	54406A64	Luggage compartment scuff plate
2	5440352	Luggage compartment back trim panel
3	5445422	Luggage compartment RH trim panel
4	5445423	Luggage compartment LH trim panel
5	—	Rear bumper cover inner fender screws (4 required)
6	—	Rear bumper cover screws (2 required)
7	17K835	Rear bumper cover
8	N807168	Rear bumper isolator rivets (2 required)
9	17787	Rear bumper isolator
10	380262	Rear exhaust hanger
11	W701835	Rear bumper bolts (4 required)
12	17906	Rear bumper

1. For additional information, refer to the procedures in this section.

Rear Bumper Cover

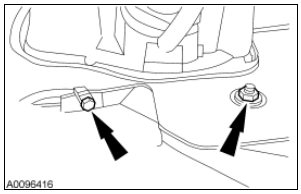
Removal and Installation

1. Remove the luggage compartment trim panels.

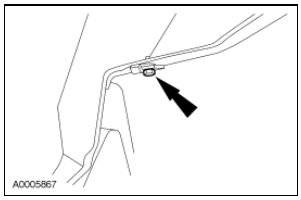
2. Remove the 4 rear bumper cover inner fender screws (2 on each side).

3. Remove the 2 rear bumper cover screws.

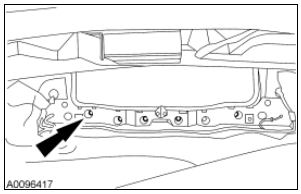
4. On the RH side, remove the rear bumper cover bolt and the nut located in the wheel well area.
   - To install, tighten to 7 Nm (62 lb-in).



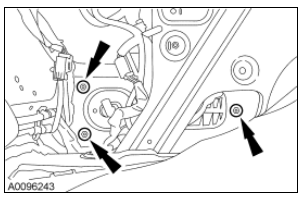
5. On the LH side, remove the rear bumper cover bolt.
   - To install, tighten to 7 Nm (62 lb-in).



6. From the luggage compartment, remove the 5 rear bumper cover nuts.
   - To install, tighten to 7 Nm (62 lb-in).



7. From the luggage compartment, remove the 6 rear bumper cover nuts (3 on each side).
   - To install, tighten to 7 Nm (62 lb-in).

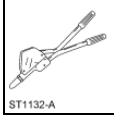


8. Remove the rear bumper cover.
   - If equipped, disconnect the electrical connector.

9. To install, reverse the removal procedure.

Rear Bumper

Special Tool(s)

 ST1132-A	Heavy Duty Riveter 501-D011 (D80L-23200-A) or equivalent

Removal and Installation

1. Remove the rear bumper cover. For additional information, refer to Rear Bumper Cover in this section.

2. Remove the 2 rivets and the rear bumper cover isolator.
   - Use the special tool to install the new rivets.

3. Remove the bolt and the exhaust bracket.
   - To install, tighten to 30 Nm (22 lb-ft).

4. Remove the 4 bolts and the rear bumper.
   - To install, tighten to 23 Nm (17 lb-ft).

5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
D-ring bolt	40	30	—
Front safety belt anchor nut	40	30	—
Front seat safety belt buckle bolt	40	30	—
Rear seat safety belt buckle nut(s)	48	35	—
Rear safety belt anchor bolt	40	30	—
Safety belt retractor bolt	40	30	—
Safety belt shoulder height adjuster bolts	40	30	—
Child safety seat tether anchor bolt	20	15	—
Child safety seat tether anchor — LATCH	10	—	89

Safety Belt System

⚠ WARNING: All safety belt assemblies including retractors, buckles, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjusters, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. Ford recommends new safety belt assemblies be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Safety belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The Automatic Locking Retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child seat is functioning properly, in addition to other checks for correct safety belt system function. A belt and retractor assembly must be replaced if the safety belt assembly's "automatic locking retractor" feature or any other safety belt function is not operating properly when inspected according to the functional inspection procedures in the workshop manual. Failure to replace the belt and retractor assembly could increase the risk of injury in collisions.

⚠ WARNING: Each seating position in the vehicle has a specific safety belt assembly which consists of one buckle and one tongue. The safety belt assembly is designed to be used as a pair and is not to be used across seating positions.

⚠ WARNING: Never put a rear-facing child seat on the front seat of a vehicle with a passenger airbag. If the airbag deploys, it can hit the back of the child seat with enough force to cause severe personal injury or death to the infant.

⚠ WARNING: A forward-facing child safety seat should only be placed in the front seat when it is unavoidable. If you must place a forward facing child seat in the front, always move the seat as far back as possible, because the force of the deploying front passenger air bag could cause death or serious injury to the infant. If the vehicle is equipped with a passenger airbag deactivation switch, the passenger airbag must be deactivated.

NOTE: New safety belt buckles, height adjusters, center adjust tongues and belts and retractors can be installed separately. However, if a safety assembly was in use during a collision, a new belt and retractor must be installed as well as the center adjust tongue, and belt and buckle assembly or the center adjust tongue, and the cable and buckle assembly. When installing new safety belts and buckles, height adjusters, safety cables and buckles, center adjust tongues, and belt and retractors, use only the parts specified in the Ford Master Parts Catalogs for the make and model of the vehicle being repaired. Safety belt assemblies must not be interchanged between vehicle models.

The active restraint system consists of:

- front seat safety belt retractor pretensioners with adjustable D-rings.
- front seat safety belt buckles attached to the power seat track bracket.
- rear seat safety belt retractors attached to the C-pillar behind the corner trim panel.
- the rear center safety belt retractor, which is located under the package tray trim.
- the rear LH, RH and center buckle ends, which are secured to the rear floor pan under the rear seat.
- child safety seat tether anchors located in the rear at all 3 seating positions.
- child safety seat LATCH system located at the rear outboard seating positions, behind the rear seat backrest.

When installing new safety belt buckles and/or retractor assemblies, use only the replacement parts specified in the Ford Customer Service Division Master Parts and Accessories Catalog.

Safety Belt Retractor Pretensioners

The front outboard safety belt retractors use a safety belt pretensioner system. This works in conjunction with the front air bag system mounted in the steering wheel and instrument panel. The pretensioner is a pyrotechnic device that removes excess webbing slack from the safety belt. When the front air bags are deployed, the pretensioner deploys in the retractor, removing excess slack from the lap and shoulder safety belt. The pretensioners are activated when the restraints control module (RCM) detects a frontal impact force exceeding a programmed limit. If the vehicle is involved in a collision that results in deployment of the front air bags and safety belt pretensioners, a new driver and passenger seat belt system (including safety belt buckle and pretensioners or safety belt retractor and pretensioners, safety belt retractors, safety belts, buckles and height adjusters), must be installed.

For additional information, refer to Section 501-20B .

Dual Locking Mode Retractors

NOTE: When replacing a dual locking mode retractor, the retractor should be checked to make sure it is not in the automatic locking retractor (ALR) mode after installation in the stowed position.

All continuous-loop, 3-point retractor systems, except the driver position, are equipped with the dual locking mode system.

The emergency locking retractor (ELR) mode will allow the occupant freedom of movement, locking tight only on hard braking, hard cornering, or an impact of approximately 8 km/h (5 mph). The ELR mode helps to reduce the forward movement of the driver and passengers. The ELR mode is continuously in operation at all seating positions.

The ALR portion of this system does not allow the occupant freedom of movement. The ALR mode is used when locking a child seat in an outboard seating position or when a tight belt fit is desired. The ALR mode is automatically engaged when the webbing is fully extracted from the retractor and then allowed to retract. As the webbing is retracted back onto the spool, an audible clicking sound is made indicating the retractor is in ALR mode and the webbing will not pull back out of the retractor. To disengage the ALR mode, let the webbing retract back onto the spool. The ALR mode is disengaged when the webbing is free to move out and back into the retractor.

Safety Belt Extension Assembly

In certain cases, the safety belt may be too short even when it is fully extended. About 20 cm (8 inches) can be added to the belt length by using a safety belt extension (611C22). Safety belt extensions are available through the dealership parts department at no cost. Safety belt extensions are only available with black webbing. There is one extension assembly available for the front and rear seating positions.

Use only extensions manufactured by the same supplier as the safety belt. Manufacturer identification is located at the end of the webbing on the label. Also, use the safety belt extension only if the safety belt is too short for you when fully extended. Do not use the extension to change the fit of the shoulder belt across the torso.

Safety Belt Warning System — Driver Safety Belt

The driver safety belt incorporates a safety belt warning indicator switch (10B924), warning indicator and chime. The warning indicator and chime are reminders to fasten the safety belt.

- If the driver safety belt is not buckled before the ignition key is turned to the ON position, the safety belt warning light illuminates for 1 to 2 minutes and the warning chime sounds for 4 to 8 seconds.
- If the safety belt is buckled while the warning indicator is on and the chime is sounding, the warning light and warning chime turn off.
- If the safety belt is buckled before the key is turned to the ON position, the warning indicator will come on for 4 to 8 seconds with no chime.

Belt Minder

The Belt Minder feature is a supplemental warning to the safety belt warning function. This feature provides additional reminders to the driver that the safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the instrument cluster.

If...	Then...
The driver safety belt is not buckled before the vehicle has reached at least 5 km/h (3 mph) and 1-2 minutes have elapsed since the ignition switch has been turn to ON...	The Belt Minder feature is activated — the safety belt warning light illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until safety belt is buckled.
The driver safety belt is buckled while the safety belt indicator light is illuminated and the safety belt warning chime is sounding...	The Belt Minder feature will not activate.
The driver safety belt is buckled before the ignition switch is turned to the ON position...	The Belt Minder feature will not activate.

Child Safety Seat Tether Anchors

⚠ WARNING: The child safety seat tether anchor/bolt MUST be securely tightened to specification. Otherwise, the child safety seat may not be correctly secured and the child could be injured if the vehicle is involved in a collision or stops suddenly.

Child safety seat tether anchors are located in the rear at both seating locations. If a child safety seat was in use during a collision, inspect the tether anchor and seat backrest frame for damage. Install a new tether anchor or seat backrest frame if necessary. For additional information, refer to Child Safety Seat Tether Anchor in this section.

Lower Anchors and Tethers for Children (LATCH)

The lower anchors and tethers for children (LATCH) system is a standardized and uniform attachment system for installing child safety seats in passenger vehicles. LATCH- equipped child safety seats have two lower attachments that connect to the vehicle portion of the LATCH system.

The vehicle portion of the system consists of 2 attachment points (6-mm wires) bolted to the floor pan at both second row outboard seating positions. The attachment points protrude from the biteline between the seat cushion and seat backrest.

If a child safety seat was in use during a collision, inspect the vehicle portion of the system for damage. If any of the attachment points (6-mm wires) are damaged, a new one must be installed. See the appropriate removal and installation procedure in this section for service.

Safety Belt System

Inspection and Verification

1. Verify the customer's original concern by operating the active restraint system to duplicate the condition.

2. Inspect to determine if any of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
• Inspect the safety belt webbing for integrity • Safety belt buckle and tongue assembly • Safety belt retractor	• Open fuse. • Bare, broken or disconnected wire. • Connector not tightly engaged. • Safety belt warning indicator lamp burned out or broken.

3. If the inspection reveals an obvious concern(s) that can be readily identified, service as required. With the exception of removing a twist from the safety belt webbing, do not attempt to repair a component of the safety belt system; new components must be installed.

4. If the concern remains after the inspection, determine the symptom. GO to Symptom Chart .

5. To check the active restraint system for correct operation, carry out the appropriate Functional Test(s).

Symptom Chart

SYMPTOM CHART

Component Test

Carry out the appropriate Functional Test(s) as determined in Inspection and Verification.

Functional Test I (Buckle and Tongue)

The safety belt buckle and tongue assembly must operate freely during the latching and unlatching function. Fasten the safety belt by inserting the tongue (male portion) into the buckle (female portion).

1. Verify the following during the latching sequence:
   - Tongue insertion is not hindered by excessive effort.
   - A click is heard when the buckle latches the tongue.

2. Verify the system integrity by forcefully pulling on the belt webbing.

3. Unlatch the belt by fully depressing the buckle release button, and allowing the belt to release and retract.

4. Verify the following during the unlatching process:
   - Push-button depression does not require excessive effort.
   - Tongue can be removed easily from the buckle.

5. Repeat the above steps 3 times.

6. If the inspection reveals an obvious concern(s) that can be readily identified, service as required. Do not attempt to carry out any repair on the buckle and tongue assembly. If a concern exists with either component, a new safety belt buckle and safety belt and retractor assembly must be installed.

Functional Test II (Retractor)

The safety belt and retractor assembly must be freely operational for extraction and retraction of the safety belt webbing between full extension and in-vehicle stowed positions.

1. Extract and retract the safety belt between the full extension and stowed positions.

2. Verify the retractor operates without excessive effort or binding.

3. Install a new safety belt buckle retractor and tongue assembly if no obvious concerns are noticed and the complaint has been verified.

Functional Test III (System Road Test Inspection)

1. **NOTE:** If the RH or the rear safety belts are to be tested, a passenger must be used.

   Fasten the safety belts and proceed to a safe area.

2. Attain a speed of 8 km/h (5 mph).

3. ⚠ **WARNING: The driver and passenger must be prepared to brace themselves if the retractor does not lock.**

   Test the safety belts.

   1. Grasp the shoulder harness and prepare to lean forward.
   2. ⚠ **WARNING: The maximum brake application should be on dry concrete or equivalent hard surface, NEVER on wet pavement or gravel.**

      ⚠ **WARNING: The driver and passenger must be prepared to brace themselves in the event the retractor does not lock.**

      Make a maximum brake application without a skid.
   3. **NOTE:** Do not jerk on the safety belt webbing when carrying out this test. Lean forward slightly when the brake application is made.

4. The safety belts should lock up with minimum webbing extension.

5. If there is a lockup of both shoulder straps, the safety belt assemblies are functioning correctly.

Should either or both retractors fail to lock up at the 8 km/h (5 mph) speed, repeat the test at a constant 24 km/h (15 mph) speed. (This test must be carried out with a RH front or rear passenger if the RH front or rear safety belts are to be tested).

6. **⚠ CAUTION: Before installing a new safety belt assembly, inspect the mounting area for damage and distortion. If the retractor of a new safety belt assembly has been bolted into a damaged or distorted mounting area, the retractor could be warped and may not function. If this is the case, remove the retractor and return the sheet metal to the original configuration and install another complete safety belt assembly.**

   If either or both retractors do not lock up at the 24 km/h (15 mph) test, return the vehicle for service of malfunctioning safety belts.

Functional Test IV (Automatic Locking Retractor)

⚠ WARNING: After any vehicle collision, the safety belt system at all outboard seating positions (except driver, which has no "automatic locking retractor" feature) must be checked by a qualified technician to verify that the "automatic locking" feature for child seats is still functioning properly, in addition to other checks for correct safety belt system function. A safety belt and retractor assembly must be replaced if the safety belt assembly's "automatic locking retractor" feature or any other safety belt function is not operating properly when checked according to the procedures in the workshop manual. Failure to replace the safety belt and retractor assembly could increase the risk of injury in collisions.

1. Position the seat back into the FULL UP position.
2. Position the height adjuster in the FULL DOWN or UP position.
3. Latch the seat belt buckle and tongue assembly.
4. Pull the shoulder belt out until the automatic locking retractor (ALR) feature is activated.
5. Release the shoulder belt and allow it to retract until it stops.
6. Pull on the shoulder belt to check that the belt has remained in the ALR mode. If the belt is not locked, install a new safety belt and retractor assembly.
7. Unlatch the safety belt tongue from the buckle and allow the safety belt to retract to its stowed position.
8. Pull the shoulder belt to verify the retractor assembly has converted automatically out of the ALR mode. If the shoulder belt remains locked in the stowed position, install a new safety belt and retractor assembly.

Safety Belt Cleaning

1. ⚠ **WARNING: Do not bleach or re-dye the webbing, as the webbing may weaken.**

   Clean the safety belt webbing only with a mild soap solution recommended for cleaning upholstery or carpets. Follow the instructions provided with the soap.

Safety Belt Maintenance

⚠ WARNING: All safety belt assemblies include retractors, buckles, front seat belt buckle support assemblies (slide bar), shoulder belt height adjuster, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. New belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected. New safety belt assemblies should be installed if either damage or incorrect operation is noted.

1. The safety belt assemblies should be periodically inspected to make sure that they have not become damaged and that they remain in correct operating condition, particularly if they have been subjected to severe stress.

2. Before installing the new safety belt assembly; the safety belt retaining areas must be inspected for damage and distortion. If the retaining points are damaged and distorted, the sheet metal must be reworked back to its original shape and structural integrity.

3. Install the new safety belt(s) using the appropriate instructions. Carry out the Functional Test Procedure. For additional information, refer to Safety Belt System in this section.

Replacement of the Weld Nut and Reinforcement

1. **NOTE:** If the safety belt anchor nuts or reinforcements are stripped or missing, a new nut/reinforcement plate must be installed.

   Expose the suspect anchor point.

2. Drill out two 8-mm (5/16-inch) diameter access holes adjacent to the weld nut clearance hole.

3. Thread a length of copper welding wire through the clearance hole and position to secure the weld nut and washer.

4. Use MIG wire feed welder and plug weld a M10 weld nut and standard washer in place at the two 8-mm (5/16-inch) holes.

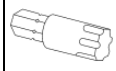
5. Metal finish as necessary.

6. Install the restraint system.

7. Carry out the Functional Test. For additional information, refer to Safety Belt System in this section.

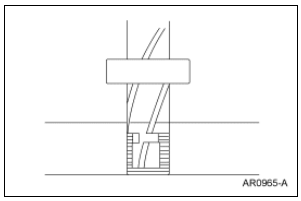
Safety Belt Shoulder Height Adjuster With Stripped Weld Nuts

Special Tool(s)

ST1657-A	D-Ring Installation Kit 100-F012 (134-00018) or equivalent
 ST1181-A	Safety Belt Bolt Bit 501-010 (T77L-2100-A) or equivalent

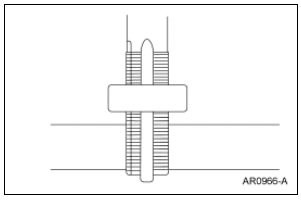
1. Remove the shoulder safety belt height adjuster. For additional information, refer to Safety Belt Shoulder Height Adjuster in this section.

2. Use the half-inch drill provided in the D-Ring Installation Kit to drill out the damaged threads in the upper pillar structure.

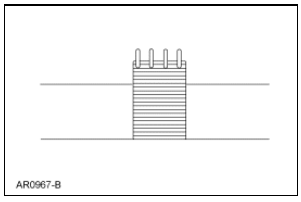

AR0965-A

3. **NOTE:** After each rotation, back off the tap slightly to remove the new cuttings and be sure to blow out any chips before proceeding.

   Apply a suitable lubricant to the M14 x 1.5 tap provided in the D-Ring Installation Kit and tap new threads.


AR0966-A

4. Use a threaded insert (Part of #N807170-S190) provided in the D-Ring Installation Kit and screw it into the retapped hole until it is slightly below the surface.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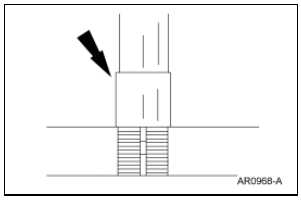
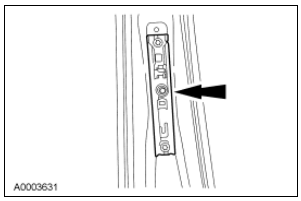
5. Use a hammer to lightly tap the installation tool provided in the D-Ring Installation Kit several times to seat the insert keys.

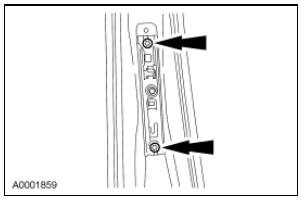


6. **NOTE:** If the shoulder safety belt height adjuster bolts are stripped, install a new height adjuster.

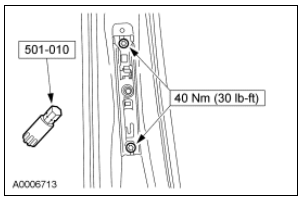
   Insert the shoulder safety belt height adjuster in the opening of the upper B-pillar structure, making sure the shoulder belt height adjuster knob on the shoulder safety belt height adjuster is positioned above the D-ring attachment nut. (The tab is located at the top and is to be inserted in the hole provided in the B-pillar structure.)



7. Hand tighten the height adjuster bolts until they are snug.

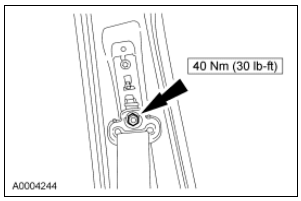


8. Using the special tool, tighten the height adjuster bolts.



9. **NOTE:** Make sure the D-ring rotates freely.

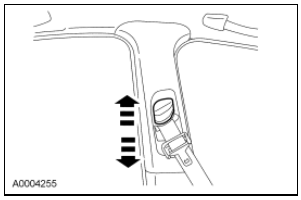
   Install the safety belt D-ring and tighten the nut.



10. **NOTE:** Position the safety belt D-ring to its highest point before installing B-pillar trim.

    Install the B-pillar trim.

11. Operate the front seat shoulder strap adjuster. Make sure it travels from top to bottom and locks correctly in each position.



12. Check the restraint system for correct operation.

Safety Belt Procedure After a Collision

⚠ WARNING: All safety belt assemblies include retractors, buckles, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjuster, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. All belt assemblies should be installed new unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected. New safety belt assemblies should be installed if either damage or incorrect operation is noted.

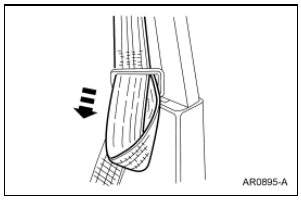
NOTE: The driver and front passenger seat belt system (including belt and retractor assembly, buckles, and height adjusters) must be replaced if the vehicle is involved in a collision that results in deployment of the front air bags and safety belt pretensioners.

1. Before installing a new safety belt assembly, the safety belt attaching areas must be inspected for damage and distortion. If the attaching points are damaged and distorted, the sheet metal must be worked back to its original shape and structural integrity.

2. Install the new safety belt(s). For additional information, refer to the procedure in this section. Carry out the Functional Test. For additional information, refer to Safety Belt System in this section.

Safety Belt Tongue Rotated on Belt

1. Grasp the belt tongue and pull the belt webbing down to form a loop through the slot in the tongue.

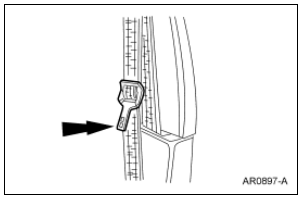


2. Rotate and fold the belt webbing over itself within the slot to remove the twist.

3. Pull the excess belt webbing back through the slot in the belt tongue.

4. Pull the excess belt webbing through the slot.

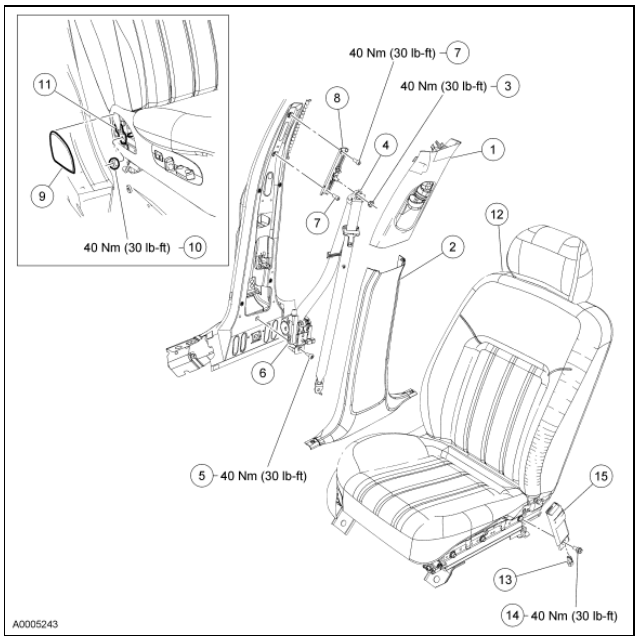
5. The safety belt tongue should face inward when completed.



Safety Belt System — Exploded View, Front

Front Safety Belt System

NOTE: Passenger side shown, driver side similar.



Item	Part Number	Description
1	5424356 RH/LH 5424357	Upper B-pillar trim panel
2	7824396 RH/ 7824397 LH	Lower B-pillar trim panel
3	N800937-S193	Safety belt D-ring nut
4	—	Safety belt D-ring (part of 611B08 RH/611B09 LH)
5	W700883- S409M	Safety belt retractor bolt
6	—	Safety belt retractor
7	—	Safety belt shoulder height adjuster bolts
8	602B82	Safety belt shoulder height adjuster
9	—	Seat side trim panel and safety belt anchor cover
10	N800937-S193	Safety belt anchor nut
11	—	Safety belt and anchor (part of 611B08 RH/611B09 LH)
12	—	Seat assembly
13	—	Safety belt buckle switch connector
14	W700883- S409M	Safety belt buckle bolt
15	61202 RH/ 61203 LH	Safety belt buckle assembly

1. For additional information, refer to the procedures in this section.

Front Safety Belt Buckle

Removal and Installation

⚠ WARNING: All safety belt assemblies including retractors, buckles, belt tension sensor (BTS), if equipped, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjusters, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. Ford recommends new safety belt assemblies be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Safety belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The Automatic Locking Retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child seat is functioning properly, in addition to other checks for proper safety belt system function. A belt and retractor assembly must be replaced if the safety belt assembly's "automatic locking retractor" feature or any other safety belt function is not operating properly when inspected according to the functional inspection procedures in the workshop manual. Failure to replace the belt and retractor assembly could increase the risk of injury in collisions.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, the SRS must be depowered.

NOTE: The air bag warning lamp illuminates when the restraint control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. **⚠ CAUTION: Use care when handling the seat and track assembly. Dropping the assembly or sitting on a seat not secured in the vehicle may result in damaged components.**

   Remove the affected seat from the vehicle and depower the system. For additional information, refer to Section 501-10 .

2. Disconnect the safety belt buckle electrical connector.

3. Remove the bolt and the safety belt buckle.
   - To install, tighten to 40 Nm (30 lb-ft).

4. To install, reverse the removal procedure.

5. Install the affected seat and repower the system. For additional information, refer to Section 501-10 .

6. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Front Safety Belt Retractor and Pretensioner

Removal and Installation

⚠ WARNING: All safety belt assemblies including retractors, buckles, belt tension sensor (BTS), if equipped, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjusters, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. Ford recommends new safety belt assemblies be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Safety belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The Automatic Locking Retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child seat is functioning properly, in addition to other checks for proper safety belt system function. A belt and retractor assembly must be replaced if the safety belt assembly's "automatic locking retractor" feature or any other safety belt function is not operating properly when inspected according to the functional inspection procedures in the workshop manual. Failure to replace the belt and retractor assembly could increase the risk of injury in collisions.

⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the restraint control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

2. Remove the upper and lower B-pillar trim panels. For additional information, refer to Section 501-05 .

3. Remove the nut and the safety belt D-ring.
   - To install, tighten to 40 Nm (30 lb-ft).

4. Remove the safety belt anchor nut and safety belt anchor from the seat.
   - To install, tighten to 40 Nm (30 lb-ft).

5. Remove the seat side trim panel safety belt anchor cover.

6. Remove the safety belt retractor lower bolt and the safety belt retractor.
   - To install, tighten to 40 Nm (30 lb-ft).

7. To install, reverse the removal procedure.

8. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

Safety Belt Shoulder Height Adjuster

Removal and Installation

⚠ WARNING: All safety belt assemblies including retractors, buckles, belt tension sensor (BTS), if equipped, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjusters, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. Ford recommends new safety belt assemblies be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Safety belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The Automatic Locking Retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child seat is functioning properly, in addition to other checks for proper safety belt system function. A belt and retractor assembly must be replaced if the safety belt assembly's "automatic locking retractor" feature or any other safety belt function is not operating properly when inspected according to the functional inspection procedures in the workshop manual. Failure to replace the belt and retractor assembly could increase the risk of injury in collisions.

NOTE: The passenger side safety belt shoulder height adjuster is shown, the driver side is similar.

1. Remove the upper B-pillar trim panel. For additional information, refer to Section 501-05 .

2. Remove the nut and the safety belt D-ring.
   - To install, tighten to 40 Nm (30 lb-ft).

3. Remove the height adjuster bolts.
   - To install, tighten to 40 Nm (30 lb-ft).

4. **NOTE:** Rotate the safety belt shoulder height adjuster downward to release the lower tab.

   Remove the safety belt shoulder height adjuster.

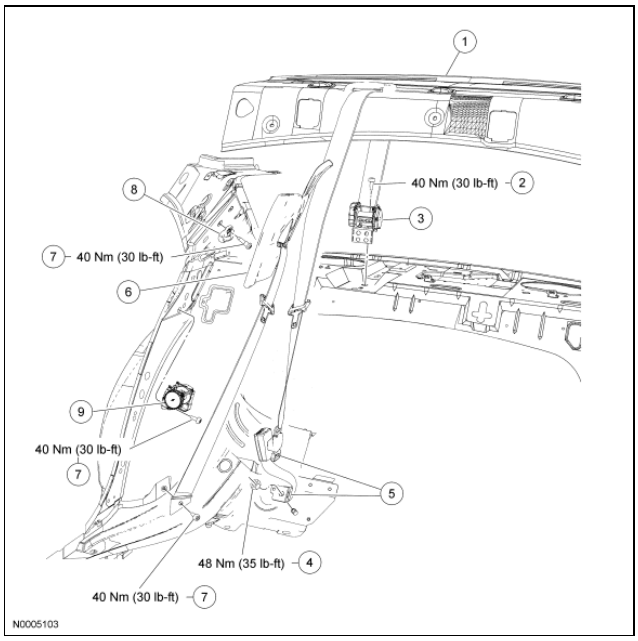
5. To install, reverse the removal procedure.

6. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt System — Exploded View, Rear

Rear Safety Belt System

NOTE: RH rear safety belt components shown, LH similar.



Item	Part Number	Description
1	—	Package tray trim panel
2	W700883	Bolt, center seat safety belt retractor
3	601B30	Center seat safety belt and retractor assembly
4	N800937-S193	Nut, right side and center buckle anchor
5	60045	Right side and center buckle assembly
6	RH 52018 / LH 52017	Quarter panel trim
7	W700883- S409M	Safety belt retractor and D-ring bolts
8	—	D-ring (part of 611B68 RH/611B69 LH)
9	611B68 RH/ 611B69 LH	Safety belt retractor

1. For additional information, refer to the procedures in this section.

Rear Safety Belt Retractor

Removal and Installation

⚠ WARNING: All safety belt assemblies including retractors, buckles, belt tension sensor (BTS), if equipped, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjusters, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. Ford recommends new safety belt assemblies be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Safety belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The Automatic Locking Retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child seat is functioning properly, in addition to other checks for proper safety belt system function. A belt and retractor assembly must be replaced if the safety belt assembly's "automatic locking retractor" feature or any other safety belt function is not operating properly when inspected according to the functional inspection procedures in the workshop manual. Failure to replace the belt and retractor assembly could increase the risk of injury in collisions.

1. Remove the rear seat bolster. For additional information, refer to Section 501-10 .
2. Remove the rear quarter trim panel. For additional information, refer to Section 501-05 .
3. Remove the rear safety belt retractor anchor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).
4. Remove the bolt and D-ring.
   - To install, tighten to 40 Nm (30 lb-ft).
5. Remove the bolt and the rear safety belt retractor.
   - To install, tighten to 40 Nm (30 lb-ft).
6. To install, reverse the removal procedure.
7. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Rear Center Safety Belt Retractor

Removal and Installation

⚠ WARNING: All safety belt assemblies including retractors, buckles, belt tension sensor (BTS), if equipped, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjusters, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. Ford recommends new safety belt assemblies be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Safety belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The Automatic Locking Retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child seat is functioning properly, in addition to other checks for proper safety belt system function. A belt and retractor assembly must be replaced if the safety belt assembly's "automatic locking retractor" feature or any other safety belt function is not operating properly when inspected according to the functional inspection procedures in the workshop manual. Failure to replace the belt and retractor assembly could increase the risk of injury in collisions.

1. Using a suitable tool, release the mini-buckle.

2. Remove the retractor cover.

3. Remove the bolt and the rear center safety belt retractor assembly.
   - To install, tighten to 40 Nm (30 lb-ft).

4. To install, reverse the removal procedure.

5. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Rear Safety Belt Buckle

Removal and Installation

⚠ WARNING: All safety belt assemblies including retractors, buckles, belt tension sensor (BTS), if equipped, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjusters, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. Ford recommends new safety belt assemblies be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Safety belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted.

The Automatic Locking Retractor (ALR) feature of the safety belt retractor must be checked by a qualified technician to verify that the ALR feature for a child seat is functioning properly, in addition to other checks for proper safety belt system function. A belt and retractor assembly must be replaced if the safety belt assembly's "automatic locking retractor" feature or any other safety belt function is not operating properly when inspected according to the functional inspection procedures in the workshop manual. Failure to replace the belt and retractor assembly could increase the risk of injury in collisions.

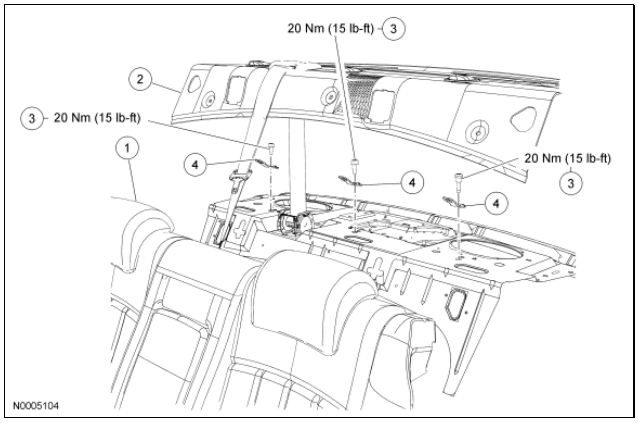
1. Using a suitable tool, release the mini-buckle.
2. Remove the rear seat cushion. For additional information, refer to Section 501-10 .
3. Remove the anchor nut and the rear safety belt buckle assembly.
   - To install, tighten to 48 Nm (35 lb-ft).
4. To install, reverse the removal procedure.
5. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Child Safety Seat Tether Anchor

Material

Item	Specification
Clear Silicone Rubber F7AZ-19554-CA	ESB-M4G92-A

Child Safety Seat Tether Anchor



Item	Part Number	Description
1	—	Rear seat
2	46668	Package tray trim panel
3	700414-S309	Tether anchor bolts
4	54612K27	Tether anchor

Removal and Installation

⚠ **WARNING: All safety belt assemblies including retractors, buckles, front seat belt buckle support assemblies (slide bar), shoulder belt height adjusters (if so equipped), child safety seat tether attachments and attaching hardware should be inspected after any collision. All belt assemblies should be installed new unless a qualified technician finds the assemblies show no damage and operate properly. Belt assemblies not in use during a collision should also be inspected and installed new if either damage or improper operation is noted.**

NOTE: Sealant **must** be applied to the tether anchor bolts when installed.

1. Remove the rear seat cushion and rear seat bolsters. For additional information, refer to Section 501-10 .

2. Remove the package tray trim panel. For additional information, refer to Section 501-05 .

3. Remove the tether anchor bolt and the safety seat tether anchor.
   - To install, tighten to 20 Nm (15 lb-ft).

4. To install, reverse the removal procedure.

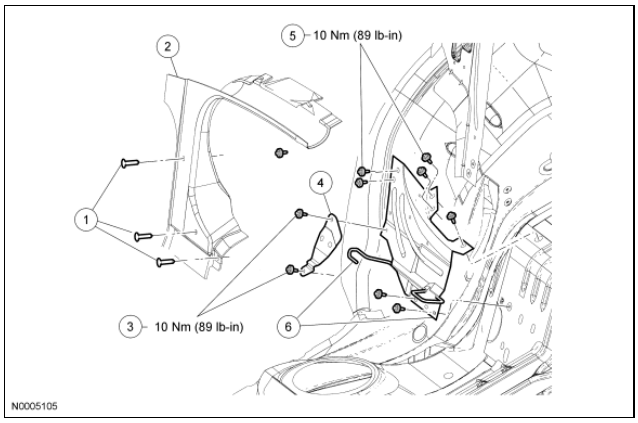
Child Safety Seat Tether Anchor — LATCH

Material

Item	Specification
Clear Silicone Rubber F7AZ-19554-CA	ESB-M4G92-A

Child Safety Seat Tether Anchor — Lower Anchors and Tethers for Children (LATCH)

NOTE: RH rear latch shown, LH rear similar.



Item	Part Number	Description
1	—	Pin-type retainers
2	54613E86	Finish panel
3	—	LATCH bracket bolts
4	544648	LATCH bracket
5	—	LATCH bolts
6	54466A81	LATCH

Removal and Installation

⚠ **WARNING: All safety belt assemblies including retractors, buckles, front seat belt buckle support assemblies (slide bar), shoulder belt height adjusters (if so equipped), child safety seat tether attachments and attaching hardware should be inspected after any collision. All belt assemblies should be installed new unless a qualified technician finds the assemblies show no damage and operate properly. Belt assemblies not in use during a collision should also be inspected and installed new if either damage or improper operation is noted.**

NOTE: Sealant must be applied to the tether anchor bolts when installed.

1. Remove the rear seat bolsters. For additional information, refer to Section 501-10 .

2. Remove the rear seat backrest and position aside the carpet. For additional information, refer to

Section 501-10 .

3. Remove the pin-type retainers and the finish panel.

4. Remove the lower anchors and tethers for children (LATCH) bracket bolts and LATCH bracket.
   - To install, tighten to 10 Nm (89 lb-in).

5. Remove the LATCH bolts and the LATCH.
   - To install, tighten to 10 Nm (89 lb-in).

6. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Front impact severity sensor	12	9	—
Side impact sensor bolts	12	9	—
Restraints control module (RCM)	12	9	—
Driver air bag module bolts	12	9	—
Passenger air bag module bolts	9	—	80
Passenger air bag module nuts	9	—	80
Side air bag module nuts	9	—	80
Side air curtain module bolts	4	—	35
Seat track nuts	20	15	—
Weld nut repair bolt (8 mm) (N802455-S190)	15	11	—
Grounding bolt (6 mm) (N806327-S190)	12	9	—

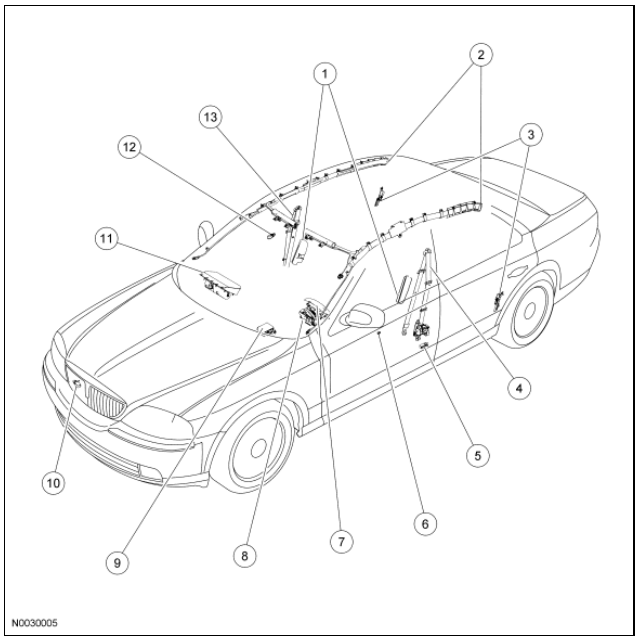
Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

The air bag supplemental restraint system (SRS) is designed to provide increased collision protection for front seat occupants in addition to that provided by the 3-point safety belt system. The SRS will also provide increased collision protection for the rear occupants when equipped with optional side air curtains. Safety belt use is necessary to obtain the best occupant protection and to receive the full advantage of the SRS.

This vehicle line contains dual-stage deployment (advanced restraint system) driver and front passenger air bag modules. These vehicles are also equipped with seat side air bag modules and optional side air curtain modules.

Vehicles equipped with side air curtain modules are also equipped with seat side thorax air bag modules. Vehicles that are not equipped with side air curtain modules are equipped with seat side air bag modules. Seat side air bag modules and seat side thorax air bag modules deploy from the outboard front seat backrest upon a side impact. Side air curtain modules deploy from the headliner, protecting the first and second row outboard occupants during a side impact.

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) Components



Item	Part Number	Description
1	611D11/611D10	Seat side air bag modules
2	042D94/042D95	Side air curtain modules (if equipped)
3	14B345	Side impact sensors — second row, C-pillar
4	611B08	Passenger safety belt retractor pretensioner
5	14B345	Side impact sensor — driver, first row, B-pillar
6	14B416	Seat position sensor
7	043B13	Driver air bag module
8	14A664	Clockspring
9	14B321	Restraints control module
10	14B004	Front impact severity sensor

11	044A74	Passenger air bag module
12	14B345	Side impact sensor — passenger, first row, B-pillar
13	611B09	Driver safety belt retractor pretensioner

Driver Air Bag Module

NOTE: References to the driver air bag module must not be confused with the driver seat side air bag components of the supplemental restraint system (SRS).

The driver air bag module:

- is steering wheel mounted.
- will deploy upon receiving a flow of current from the restraints control module (RCM).
- has no subassemblies.

Clockspring

The clockspring:

- is mounted on the steering column, behind the steering wheel.
- provides a continuous electrical path from the driver air bag module to the restraints control module (RCM).

Seat Side Air Bag Modules and Seat Side Thorax Air Bag Modules

NOTICE: **When installing a seat side air bag module or a seat side thorax air bag module always make sure the correct module is being installed. Seat side air bag modules and seat side thorax air bag modules are not interchangeable. The electrical connectors are different between the modules. DO NOT damage or alter the electrical connectors.**

NOTE: When installing a new side air bag module or a new side thorax air bag module after deployment, refer to Section 501-10 for additional information.

This vehicle is equipped with a seat side air bag module or a seat side thorax air bag module. The modules are not interchangeable. The electrical connectors are keyed differently between the modules. **DO NOT** damage or alter the electrical connectors in any way.

A specific seat side air bag wiring harness is used for a seat side air bag module, with a unique, specific seat side air bag wiring harness used for a seat side thorax air bag module. The electrical connectors to the module and to the body main wiring harness are keyed differently on a seat side air bag wiring harness than those used on a seat side thorax air bag wiring harness. The seat side air bag wiring harness and the seat side thorax air bag wiring harness are not interchangeable.

Seat Side Air Bag Modules

The seat side air bag module is a carryover component used on prior model year vehicles. A seat side air bag module provides combined protection of the head area and thorax area (between the neck and abdomen) of the body. A seat side air bag module is physically larger than a seat side thorax air bag module. Although a seat side air bag module and a seat side thorax air bag module are similarly mounted to the front seat backrests, **the modules are not interchangeable.** Vehicles equipped with a seat side air bag module will not be equipped with side air curtain modules.

The seat side air bag module:

- will deploy upon receiving a flow of current from the restraints control module (RCM) initiated by the side impact sensor and internal RCM circuitry.
- is installed as an assembly.
- is mounted in the front seat backrests.
- is not interchangeable with a seat side thorax air bag module.

Seat Side Thorax Air Bag Modules

The seat side thorax air bag module is a new component being introduced on this vehicle. A seat side thorax air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a side air curtain module. A seat side thorax air bag module is physically smaller than a seat side air bag module. Although a seat side thorax air bag module and a seat side air bag module are similarly mounted to the front seat backrests, **the modules are not interchangeable.** Vehicles equipped with seat side thorax air bag modules will also be equipped with side air curtain modules.

The seat side thorax air bag module:

- will deploy upon receiving a flow of current from the restraints control module (RCM) initiated by the side impact sensors and internal RCM circuitry.
- is installed as an assembly.
- is mounted in the front seat backrests.
- is used in conjunction with a side air curtain.
- is not interchangeable with a seat side air bag module.

Side Air Curtain Module

⚠ WARNING: The side air curtain must be installed in the vehicle using new torque-prevailing type U-nuts, part number W520822. Use of this U-nut is mandatory so as to reduce the risk of loss of fastener effectiveness. Failure to follow these instructions can result in personal injury in the event of a side air curtain deployment.

⚠ WARNING: Anytime the side air curtain has deployed, the headliner, and all A-, B-, and C-pillar upper trim panels and attaching hardware must be replaced along with any other damaged components and hardware. Failure to do so can result in personal injury in the event of a side air curtain deployment.

NOTE: If the headliner has the word "AIRBAG" embossed on it near each B-pillar, the vehicle is equipped with side air curtain modules.

The side air curtain module:

- will deploy upon receiving a flow of current from the restraints control module (RCM) initiated by the side impact sensors and internal RCM circuitry.
- is installed as an assembly.
- is mounted above the headliner.
- attaches from the A-pillar frame to the C-pillar frame.
- cannot be interchanged from side to side.

Side Air Curtain Bridge Resistor

NOTE: Do not deactivate the side air curtain module circuit by removing the bridge resistor from the electrical connector.

If the side air curtain bridge resistor is removed, an open circuit fault will be generated by the restraints control module (RCM).

If a restraint system diagnostic tool is installed at the side air curtain electrical connector, a low-resistance fault will be generated.

The side air curtain bridge resistors:

- are equipped on vehicles without side air curtain modules.
- must not be removed in the deactivation procedure.
- are located on the driver side of the vehicle on the 14401 wiring harness. For additional information, refer to Wiring Diagrams Cell 151 for side air curtain bridge resistor locations.

Occupant Classification Sensor

NOTE: It is necessary to rezero the OCS system when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS service kit is installed. A diagnostic tool is used to trigger the active command to carry out rezeroing of the OCS system.

NOTE: The OCS is found only on the front passenger seat and is not equipped on all vehicles. A white tag having the letters OCS will appear under the front of the passenger seat to identify a seat equipped with an occupant classification sensor.

The seat OCS system is found only on the front passenger seat. The front passenger seat OCS system is comprised of a silicone gel-filled bladder mounted in the seat cushion, a pressure sensor that is mounted to the seat frame and an electronic control unit which is also mounted to the seat frame. Pressure is applied to the OCS bladder when weight of any occupant or object in the front passenger seat is present. The pressure is then transferred through a tube, is sensed by the OCS pressure sensor, then electronically communicated to the OCS electronic control unit. Based on programed limits, the OCS electronic control unit will inform the restraints control module (RCM), via a High Speed Controller Area Network (CAN), of the necessary information. The RCM uses this information in determining if the passenger air bag module or passenger seat side air bag module is to be deployed in the event of a deployable collision. The OCS system components (seat cushion foam pad, bladder with pressure sensor and electronic control unit) are calibrated to each other and are serviced as an assembly. **OCS system components are not to be installed separately.** If installing a new OCS system, OCS system component or seat cushion foam pad, a new OCS system service kit (seat cushion foam pad, bladder with pressure sensor and electronic control unit) must be installed as an assembly.

Passenger Air Bag Module

NOTE: References to the passenger air bag module must not be confused with the passenger seat side air bag components of the supplemental restraint system (SRS).

The passenger air bag module:

- will deploy upon receiving a flow of current from the restraints control module (RCM) initiated by the front impact severity sensor and internal RCM circuitry.
- is installed as an assembly.
- is mounted in the passenger side of the instrument panel.

Safety Belt Pretensioners

As part of the supplemental restraint system (SRS), the safety belt retractors are equipped with pretensioners. The safety belt retractor pretensioners rotate the safety belt retractors to remove excess slack from the safety belt webbing. The pretensioners are activated by the restraints control module (RCM) when the module detects a frontal impact event exceeding a programmed limit.

Safety Belt Switch

As part of the supplemental restraint system (SRS), the driver and passenger safety belt buckles are equipped with a belt buckle connect switch. The safety belt switches indicate to the restraints control module (RCM) whether the safety belt buckles are connected or disconnected.

The safety belt switches are also used for the driver safety belt warning system and the driver and passenger belt minder. For additional information, refer to Section 501-20A .

Seat Position Sensor

The seat track position sensor is a Hall-effect sensor located on the driver seat track. Based on programmed limits, the seat track position sensor will inform the restraints control module (RCM) of the driver seat position. The RCM uses this information in determining the deployment rate of the dual-stage driver air bag module

Restraints Control Module (RCM)

⚠ WARNING: The restraints control module (RCM) orientation is critical for correct air bag supplemental restraint system (SRS) operation. If a vehicle equipped with an SRS system has been involved in a collision in which the center tunnel area has been damaged, inspect the mounting and bracket for deformation. If damaged, the RCM must be replaced whether or not the air bags have deployed. In addition, make sure the area of the RCM mounting is restored to its original condition.

NOTE: When installing a new restraints control module (RCM), always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.

The restraints control module (RCM) is mounted on the center tunnel under the instrument panel. The RCM carries out the following functions:

- supplies current flow to the inflators to deploy the air bags in the event of a deployable crash.
- activates the safety belt retractor pretensioners to remove slack from the safety belt.
- monitors the air bag supplemental restraint system (SRS) for faults.
- illuminates the air bag indicator if a fault is detected.
- flashes the air bag indicator to indicate the lamp fault code (LFC) detected.
- communicates through the data link connector (DLC) the current or historical diagnostic trouble codes (DTCs).
- signals the instrument cluster module to activate a chime if the air bag indicator is not available and another SRS fault exists.
- contains an internal safing sensor which is not serviced separately.
- records deployment event data.

The RCM monitors the SRS for possible faults. If a fault is detected while the ignition switch is in the RUN

position, the RCM will illuminate the air bag indicator located in the instrument cluster.

When the ignition is cycled (turned off and then on), the air bag indicator will remain lit for 6 seconds and then go out. If an SRS fault exists, the air bag indicator will then flash the 2-digit LFC. The air bag indicator will flash the LFC 3 times, then it will remain illuminated for the rest of the key cycle. The RCM will also communicate the current and historical DTCs through the (DLC), using a diagnostic tool. If the air bag indicator does not function, and the system detects a fault condition, the RCM will signal the instrument cluster module to activate an audible chime. The chime is a series of 5 sets of 5 tone bursts. If the chime is heard, the SRS and the air bag indicator require repair.

LFCs are prioritized. If 2 or more faults occur at the same time, the fault having the highest priority will be displayed first. After that fault has been corrected, the next highest priority fault will be displayed.

The RCM includes a backup power supply. This feature provides sufficient current to deploy the front air bags and safety belt pretensioners in the event that the ignition circuit is damaged or lost in a collision before the RCM determines that air bag deployment is required. The backup power supply will deplete its stored energy approximately one minute after the battery ground cable is disconnected.

Electrical System

The electrical system that supports the air bag supplemental restraint system (SRS):

- receives power from the battery through the ignition circuit.
- provides the electrical path from the restraints control module (RCM) to the SRS components.
- provides the electrical ground path for the air bag indicator.
- provides the electrical path from the RCM to the data link connector (DLC).
- provides the electrical ground path from the instrument cluster to the RCM.

Impact Sensors

⚠ WARNING: The restraints control module (RCM) orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) has been involved in a collision in which the vehicle center tunnel area has been damaged, inspect the RCM mounting and bracket for deformation. If damaged, the RCM must be replaced whether or not the air bags have deployed. In addition, make sure the area of the RCM mounting is restored to its original condition.

All vehicles will have a front impact severity sensor located behind the front radiator grille. In addition, there are 2 side impact sensors located on the driver and passenger side near the B-pillars. In addition to the B-pillar side impact sensors there are 2 additional side impact sensors mounted near the driver and passenger C-pillars when the vehicle is equipped with driver and passenger side air curtain modules. The RCM is mounted on the center tunnel under the instrument panel. Mounting orientation is critical for correct operation of all impact sensors.

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Special Tool(s)

ST1137-A	FLUKE 73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Restraint System Diagnostic Tool Warning

⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards.

Diagnosing Customer Concerns Without Hard DTCs

If a lamp fault code (LFC) is reported by the customer but is not present when the vehicle comes in for service, follow the Diagnostic Instruction procedures in this section to identify the intermittent DTC.

Once the DTC is known, read the Normal Operation section of the pinpoint test for the DTC involved.

- Follow the deactivation or depowering procedure in this section.
- Determine the location of components involved in creating the DTC.
- Carry out a thorough visual inspection of:
  - components.
  - connectors.
  - splices and wiring harnesses.
  - insulation on conductors.

Refer to the Possible Causes section of the pinpoint test for the DTC involved, which lists the common concerns that relate to the DTC. Concerns are listed according to priority.

Diagnosing Customer Concerns with Hard DTCs

Most Supplemental Restraint System (SRS) diagnostic procedures will require deactivation and reactivation or depowering and repowering of the system. Deactivation and reactivation requires the disconnection of most SRS components and the installation of restraint system diagnostic tools. Depowering and repowering requires disconnecting of the battery and removal of the restraints control module (RCM) fuse. This reduces the risk of inadvertent deployment of SRS components while diagnostic procedures are being carried out.

Restraint system diagnostic tools are required for the diagnosis and testing of the SRS. It is not acceptable to short-circuit the air bag module connections with a jumper wire. If a jumper wire is used to short-circuit the air bag module connections, a lamp fault code (LFC) will be displayed.

Prove Out Procedure

Turn the ignition switch from the OFF to the ON position and visually monitor the air bag indicator with all SRS components connected or restraint system diagnostic tools installed. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag indicator will:

- fail to light.
- remain lit continuously.
- flash.

The flashing might not occur until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the restraints control module (RCM) to complete the testing of the SRS. If the air bag indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator will need to be repaired before diagnosis can continue.

Glossary

Secondary Air Bag Warning

The secondary air bag warning is an audible fault format that consists of 5 sets of 5 tone bursts, with each set of 5 tone bursts separated by a 5 second quiet period. One tone burst cycle will consist of one second ON and one second OFF. This series of 5 activations is repeated every 30 minutes.

Air Bag/Pretensioner Restraint System Diagnostic Tools

Air bag/pretensioner restraint system diagnostic tools are used to simulate the equivalent resistance of an air bag module or safety belt pretensioner during certain diagnostic procedures.

Disconnect the Component

Disconnect the component means to disconnect the component vehicle harness connector, not to remove the component. Do not reconnect a disconnected component unless instructed to do so.

Deactivate the System

Deactivate the system means to carry out a deactivation procedure. For additional information, refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

Depower the System

Depower the system means to disconnect the battery and remove the restraints control module (RCM) fuse. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Prove Out the System

Prove out the system means to turn the ignition switch from the OFF to the ON position, and to visually

monitor the air bag indicator with the air bag modules and safety belt pretensioners or restraint system diagnostic tools installed. For additional information, refer to Prove Out Procedure in this section.

Reactivate the System

Reactivate the system means to carry out the reactivation procedure. For additional information, refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

Repower the System

Repower the system means to remove any restraint system diagnostic tools that may have been installed, turn the ignition ON, install the RCM fuse, and connect the battery ground cable. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Reconnect the System

Reconnect the system means to reconnect all system components. For additional information, refer to Air Bag System Reconnect Checklist in this section.

Install a New Component

Install a new component means to remove the existing component and install a new authorized part obtained from Ford Customer Service Division.

Verify the System

Verify the system means to prove out the system with restraint system diagnostic tools installed in place of the SRS components.

Air Bag Reconnect Checklist

The checklist below should be completed following diagnosis or repair of any air bag system concern:

- All restraint system diagnostic tools removed?
- All in-seat harness connectors connected?
- All air bag modules connected?
- Safety belt pretensioner connectors connected?
- Restraints control module (RCM) connected?
- All sensors (front and side impact sensors) connected?
- Battery connected?

Diagnostic Instructions — Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

The symptom chart can be used to help locate supplemental restraint system (SRS) concerns if no diagnostic trouble codes (DTCs) are retrieved and the listed symptoms are observed. Whether or not the listed symptoms are observed, always carry out the following:

1. Retrieve all DTCs stored in the restraints control module (RCM) memory. For additional information, refer to Retrieve/Clear Continuous DTCs in this section.

2. Run the On-Demand Self Test to determine what DTCs are currently being sensed by the RCM. Refer to On-Demand Self Test in this section.

3. If the stored DTCs are different than the current DTCs, always repair the current DTCs first.

4. If memory displays different continuous DTCs than the On-Demand Self Test, carry out in the following order:

- On-Demand Self Test
- Memory (Retrieve/Clear Continuous DTCs)

A DTC can indicate several concerns. The DTCs are to assist in system diagnosis and are not to be considered definitive. Always refer to the pinpoint test corresponding to the DTC to determine where the concern lies and to repair the concern correctly.

The SRS diagnostics can be divided into 3 sections:

- Diagnostic test modes
- PID/data monitor and record
- Active command modes

Diagnostic Test Modes

Two menu options are available under the diagnostic test modes:

- Retrieve/Clear Continuous DTCs
- On-Demand Self Test

Retrieve/Clear Continuous DTCs

During vehicle operation, the restraints control module (RCM) will detect and store both intermittent and hard failure DTCs in nonvolatile memory. The DTC strategy employed by the RCM incorporates a time-out scheme for determining when a concern exists in the system. This requires a concern to exist for up to one minute in the system before the RCM will detect it. For the RCM to determine that a concern no longer exists, the concern must be absent for up to one minute. The actual detection time-outs vary with each DTC. The DTCs can be retrieved with a diagnostic tool using the retrieve/clear continuous DTCs option. Any DTCs stored in the RCM will be displayed on the diagnostic tool along with a brief description of the DTC. If no DTCs are present, the diagnostic tool will display a SYSTEM PASSED message. This option can also be used to clear DTCs from the RCM memory, as long as the concern no longer exists. Once 128 key cycles have been recorded since the concern was last detected, the DTC will automatically be removed from memory.

To retrieve or clear DTCs, follow these steps:

1. Connect the diagnostic tool to the data link connector (DLC).

2. Turn the ignition switch to the ON position.

3. Follow the manufacturer's instructions for the diagnostic tool being used.

4. **NOTE:** Before proceeding with the clearing operation, make note of the DTCs displayed. Once cleared, DTCs cannot be retrieved.

   All continuous DTCs will be displayed on the screen.

5. Clear the DTCs. After clearing the DTCs, cycle the key OFF, then ON.
   - Continuous DTCs that have been cleared will **not** re-occur as "Continuous" in the same key cycle. Only new DTCs which were **not** present before clearing can occur as "Continuous" after clearing.

On-Demand Self Test

The On-Demand Self Test option is used to verify that no electrical concerns exist with the air bag SRS. Upon entering the self-test, the restraints control module (RCM) will make an electrical check of each electrical component in the system. If a concern is detected, a DTC is displayed on the diagnostic tool with a brief description of the DTC. Concerns detected during the self-test are not stored in memory, unless the same concern was also detected during normal vehicle operation. The self-test should always be run after any repair to verify that the repair was successful.

To run the On-Demand Self Test, follow these steps:

1. Connect the diagnostic tool to the data link connector (DLC).

2. Turn the ignition switch to the ON position.

3. Follow the manufacturer's instructions for the diagnostic tool being used.

4. The RCM will run the On-Demand Self Test and display on-demand DTCs (reflecting hard system concerns) on the screen.

Bit-Mapped Diagnostic Trouble Codes (DTCs)

Many of the continuous and on-demand DTCs that can be present in the RCM are bit-mapped DTCs that

utilize PIDs (flagged faults). Bit-mapped DTCs are conceptually different from the previous style of DTCs. Previously, DTCs identified a specific concern for a given component and pointed to a particular diagnostic path. In the diagnostic path, PIDs are sometimes used to determine the root cause. Bit-mapped DTCs do not identify the specific concern. A bit-mapped DTC identifies the component(s) in which the concern exists. The next level (PIDs or flagged faults) identifies the specific concern.

A diagnostic tool must be used to view the PIDs (flagged faults) of a bit-mapped DTC. Once a diagnostic tool has retrieved a bit-mapped DTC, the diagnostic tool will provide the option to "FLAG" that DTC. When the option to "FLAG" the DTC is available, it must be carried out to identify the specific concern that is present. When the option to "FLAG" the DTC has been carried out, the diagnostic tool will then display the PIDs (flagged faults) for that DTC, including the status or state that exists (on-demand DTC) or existed (continuous DTC).

To view and flag bit-mapped DTCs, follow these steps:

1. Connect the diagnostic tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the diagnostic tool being used.
4. Carry out an On-Demand Self Test or retrieve continuous DTCs.
5. Select the DTC and the "FLAG" option on the diagnostic tool.
6. The diagnostic tool will display PIDs for the DTC. Record all flagged faults.

PID/Data Monitor and Record

The PID/Data Monitor and Record option allows the diagnostic tool operator to read the state of several parameter IDs (PIDs) to aid in diagnosing the system. PIDs are real time measurements of parameters such as voltages, resistances, etc., calculated by the restraints control module (RCM) and sent to the diagnostic tool for display. Many of the PIDs supported by the RCM are calculated periodically and are, therefore, not true real time readings.

To retrieve PIDs, follow these steps:

1. Connect the diagnostic tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the diagnostic tool being used.
4. Record all PIDs that are to be retrieved and initiate PID retrieval. PIDs are updated continuously on the display.

Active Commands

Instrument Cluster Module

These commands allow the technician to verify the operation of instrument cluster module components and

sub-systems.

Restraints Control Module

These commands allow the technician to verify operation of the supplemental restraint system (SRS) indicator lamps.

Lamp Fault Codes

When the restraints control module (RCM) detects a system fault, it will cause the air bag indicator to flash a coded sequence: a lamp fault code (LFC). The code is 2 digits. The first digit is flashed with a 0.5-second interval between pulses. There is a 2-second pause before the second digit is flashed, which also has a 0.5-second interval between pulses. There is a 5-second pause between each display of an LFC.

A LFC is flashed 5 times after which the air bag indictor will remain lit for the remainder of the key-on cycle. If there are multiple LFCs, only the LFC with the highest priority will flash.

Diagnostic Trouble Codes (DTCs)

While the lamp fault codes (LFCs) are an indication of a general concern in the passive restraints system, the diagnostic trouble codes (DTCs) are more specific. The DTCs can be retrieved from the restraints control module (RCM) with a diagnostic tool via the data link connector (DLC).

Inspection and Verification

1. Verify the customer concern by checking the air bag indicator in the instrument cluster. For additional information, refer to Prove Out the System in this section.

2. Visually inspect for obvious signs of mechanical and electrical damage using the following chart.

Visual Inspection Chart

Mechanical	Electrical
• Damaged restraints control module (RCM) or loose mounting • Damaged front impact severity sensor or loose mounting • Damaged side impact sensor or loose mounting	• Open central junction box (CJB) fuse 5 (10A) • Damaged wiring harness • Loose, damaged or corroded connectors • Circuitry open/shorted • Damaged shorting bars

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector and select the vehicle to be tested from the diagnostic tool menu.
   If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check that the latest diagnostic tool software release is being used.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - ISO circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - no response/not equipped for restraints control module (RCM), GO to Symptom Chart .
   - system passed, retrieve and record the continuous diagnostic trouble codes (DTCs) and carry out the on demand self test diagnostics for the RCM.

7. If the DTCs retrieved are related to the concern, go to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Restraints Control Module (RCM) DTC Chart

DTC [a]	LFC [b]	Description	Action To Take
—	Continuous	The Air Bag Indicator is Illuminated Continuously, RCM Disconnected or Inoperative, Loss of Battery Feed, or Loss of Signal Ground	GO to Pinpoint Test A .
B1231	13	Crash Data Memory Full	Install a new RCM and impact sensors. REFER to Inspection and Repair After a Supplemental Restraint System (SRS) Deployment .
B1317	Continuous	Battery Voltage High	CHECK battery voltage; to be below 16 volts. REFER to Section 414-01 .
B1318	Continuous	Battery Voltage Low	CHECK battery voltage; to be above 9.0 volts. REFER to Section 414-01 .
B1342	12	RCM Is Faulted	Install a new RCM.
B1869	NONE Continuous lamp Secondary air bag warning sounds if another fault is present	Lamp Air Bag Warning Indicator Circuit Open or Short to Ground	GO to Pinpoint Test B .
B1870	NONE Secondary air bag	Air Bag Warning Indicator Circuit Short to Battery	GO to Pinpoint Test C .

	warning sounds if another fault is present		
B1891	53	Air Bag Tone Warning Indicator Circuit Short to Battery	GO to Pinpoint Test D .
B1892	53	Air Bag Tone Warning Indicator Circuit Open or Short to Ground	GO to Pinpoint Test E .
B1921	14	Air Bag Diagnostic Monitor Ground Circuit Open	GO to Pinpoint Test F .
B2292	33	Restraint System — Safety Belt Pretensioner Fault (Driver Pretensioner Circuit Fault)	GO to Pinpoint Test G .
B2292	34	Restraint System — Safety Belt Pretensioner Fault (Passenger Pretensioner Circuit Fault)	GO to Pinpoint Test G .
B2293	19	Restraint System — Air Bag Fault (Driver Front Air Bag Circuit Fault)	GO to Pinpoint Test H .
B2293	21	Restraint System — Air Bag Fault (Passenger Front Air Bag Circuit Fault)	GO to Pinpoint Test H .
B2294	24	Restraint System — Curtain Fault (Driver Side Air Curtain Circuit Fault)	GO to Pinpoint Test I .
B2294	25	Restraint System — Curtain Fault (Passenger Side Air Curtain Circuit Fault)	GO to Pinpoint Test I .
B2295	22	Restraint System — Side Air Bag Fault (Driver Seat Side Air Bag Circuit Fault)	GO to Pinpoint Test J .
B2295	23	Restraint System — Side Air Bag Fault (Passenger Seat Side Air Bag Circuit Fault)	GO to Pinpoint Test J .
B2296	42	Restraint System — Impact Sensor Fault (Front Impact Severity Sensor Circuit Fault)	GO to Pinpoint Test K .
B2296	43	Restraint System — Impact Sensor Fault (Driver Side Front Row Impact Sensor Circuit Fault)	GO to Pinpoint Test K .
B2296	45	Restraint System — Impact Sensor Fault (Driver Side Second Row Impact Sensor Circuit Fault)	GO to Pinpoint Test K .
B2296	44	Restraint System — Impact Sensor Fault (Passenger Side Front Row Impact Sensor Circuit Fault)	GO to Pinpoint Test K .
B2296	46	Restraint System — Impact Sensor Fault (Passenger Side Second Row Impact Sensor Circuit Fault)	GO to Pinpoint Test K .
B2434	51	Driver Safety Belt Buckle Switch Circuit Short To Ground	GO to Pinpoint Test L .
B2435	51	Driver Safety Belt Buckle Switch Circuit Resistance Out Of Range	GO to Pinpoint Test M .
B2438	52	Passenger Safety Belt Buckle Switch Circuit Short To Ground	GO to Pinpoint Test N .

B2439	52	Passenger Safety Belt Buckle Switch Circuit Resistance Out Of Range	GO to Pinpoint Test O .
B2477	Continuous	Module Configuration Error	INSTALL a new RCM.
B2691	51	Driver Safety Belt Buckle Switch Circuit Fault	GO to Pinpoint Test P .
B2692	52	Passenger Safety Belt Buckle Switch Circuit Fault	GO to Pinpoint Test Q .
C1414	15	Incorrect Module Design Level	GO to Pinpoint Test R .
C1947	49	Driver Seat Track Position Sensor Circuit Short to Ground	GO to Pinpoint Test S .
C1948	49	Driver Seat Track Position Sensor Circuit Resistance Out Of Range	GO to Pinpoint Test T .
C1981	49	Driver Seat Track Position Sensor Circuit Fault	GO to Pinpoint Test U .
—	—	No Communication with the Restraints Control Module	GO to Pinpoint Test V .

[a] DTC: Diagnostic trouble code, retrieved using diagnostic tool.
[b] LFC: Lamp fault code, flashed on air bag indicator.

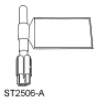
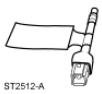
Symptom Chart

Symptom Chart

Pinpoint Tests — Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Special Tool(s)

ST1137-A	FLUKE 73 III Automotive Meter 105-R0057 or equivalent
ST2507-A	Diagnostic Tool, Restraint System (2 required) 418-133 (014-R1076)
 ST2506-A	Diagnostic Tool, Restraint System (2 required) 418-F088 (105-R0012)
ST2502-A	Diagnostic Tool, Restraint System (2 required) 418-F395 (014-R1079)
 ST2512-A	Diagnostic Tool, Restraint System (1 required) 418-F403
ST2507-A	Diagnostic Tool, Restraint System (4 required) 501-097
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Restraint System Diagnostic Tool Warning

⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards.

Pinpoint Test

Pinpoint Test A: The Air Bag Warning Indicator Is Illuminated Continuously — RCM Disconnected or Inoperative, Loss of Battery Feed, or Loss of Signal Ground

NOTE: During normal operation, the air bag indicator will illuminate continuously for 6 seconds after the ignition switch is placed to the ON or START position and after 5 cycles of a lamp fault code (LFC), if a fault exists. Be sure to cycle the ignition switch and look for a 6-second indicator prove-out without LFCs.

Normal Operation

The restraints control module (RCM) will communicate diagnostic trouble codes (DTCs) to the diagnostic tool through the data link connector (DLC). If the diagnostic tool displays NO COMMUNICATION when retrieving continuous DTCs, GO to Pinpoint Test V to troubleshoot the system.

Possible Causes

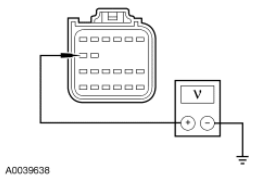
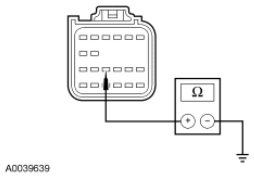
An air bag indicator that is illuminated continuously can be caused by:

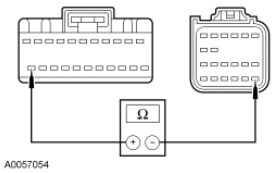
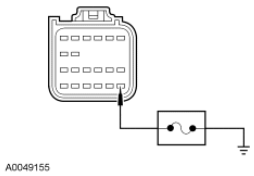
- damaged ignition circuit.
- RCM disconnected from the vehicle harness.
- a loss of RCM signal ground.
- a faulted RCM.
- damaged wiring, terminals or connectors.
- a loss of RCM battery feed.
- a faulted instrument cluster.

PINPOINT TEST A: THE AIR BAG WARNING INDICATOR IS ILLUMINATED CONTINUOUSLY — RCM DISCONNECTED OR INOPERATIVE, LOSS OF BATTERY FEED, OR LOSS OF SIGNAL GROUND

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
A1 CHECK FOR CONTINUOUS OR ON-DEMAND SELF TEST DTCs	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the**	**Yes** If continuous DTCs were retrieved, GO to A2 . If on-demand DTCs were retrieved, GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** GO to A2 .

restraint system diagnostic tools must be removed before operating the vehicle over the road. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Were any continuous or on-demand self test DTCs retrieved?**	
A2 CHECK THE RCM CONNECTION	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: RCM C310a. • **Is RCM C310a fully connected and the connector locking tab engaged?**	**Yes** GO to A3 . **No** CONNECT C310a and ENGAGE the locking tab. GO to A7 .
A3 CHECK CIRCUIT 15-JA10A (GN/OG) FOR AN OPEN	
• Disconnect: RCM C310a. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Ignition ON. • Measure the voltage between RCM C310a-12, circuit 15-JA10A (GN/OG), harness side and ground.  A0039638 • **Is the voltage between 9 and 16 volts?**	**Yes** GO to A4 . **No** VERIFY central junction box (CJB) fuse 5 (10A) is OK. If OK, REPAIR circuit 15-JA10A (GN/OG). GO to A7 .
A4 CHECK CIRCUIT 31-JA10 (BK/RD) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between RCM C310a C310a-16, circuit 31-JA10 (BK/RD), harness side and ground.  A0039639	**Yes** GO to A5 . **No** REPAIR circuit 31-JA10 (BK/RD). GO to A7 .

• **Is the resistance less than 5 ohms?**	
A5 CHECK CIRCUIT 31S-JA14 (BK/GN) FOR AN OPEN	
• Disconnect: Instrument Cluster C220a. • Measure the resistance between instrument cluster module C220a-22, circuit 31S-JA14 (BK/GN), harness side and RCM C310a-19, circuit 31S-JA14 (BK/GN), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to A6 . **No** REPAIR circuit 31S-JA14 (BK/GN). GO to A7 .
A6 CHECK THE INDICATOR LAMP OPERATION (DRIVE LAMP OFF)	
• Connect: Instrument Cluster C220a. • Ignition ON. • Connect a fused jumper between RCM C310a-19, circuit 31S-JA14 (BK/GN), harness side and ground.  • **Is the indicator lamp off?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to A7 . **No** REPAIR or INSTALL a new instrument cluster module. REFER to Section 413-01 . GO to A7 .
A7 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step A1. • **Were any continuous DTCs retrieved during Step A1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this

	section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test B: DTC B1869 — Lamp Air Bag Warning Indicator Circuit Open or Short to Ground

Normal Operation

If the restraints control module (RCM) detects an open or short to ground on the air bag warning indicator circuit, it will store diagnostic trouble code (DTC) B1869 in memory.

Possible Causes

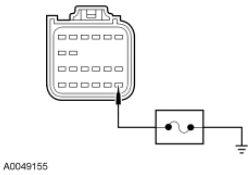
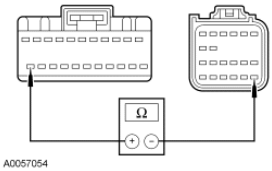
An open air bag indicator circuit can be caused by:

- damaged wiring, terminals or connectors.
- a faulted RCM.
- an instrument cluster module internal concern.

PINPOINT TEST B: DTC B1869 — LAMP AIR BAG WARNING INDICATOR CIRCUIT OPEN OR SHORT TO GROUND

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
B1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed**	**Yes** If the air bag indicator lamp **does** illuminate, GO to B2 . If the air bag indicator **does not** illuminate, GO to B4 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to B5 .

before operating the vehicle over the road. **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B1869 retrieved during the on-demand self test?**	
B2 CHECK THE INDICATOR LAMP OPERATION (DRIVE LAMP OFF)	
• Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310a. • Ignition ON. • Connect a fused jumper between RCM C310a-19, circuit 31S-JA14 (BK/GN), harness side and ground.  A0049155 • **Is the indicator lamp off?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to B6 . **No** GO to B3 .
B3 CHECK CIRCUIT 31S-JA14 (BK/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Instrument Cluster Module C220a. • Disconnect: RCM C310a. • Measure the resistance between instrument cluster module C220a-22, circuit 31S-JA14 (BK/GN), harness side and RCM C310a-19, circuit 31S-JA14 (BK/GN), harness side.  A0057054 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR or INSTALL a new instrument cluster module. REFER to Section 413-01 . GO to B6 . **No** REPAIR circuit 31S-JA14 (BK/GN). GO to B6 .
B4 CHECK THE INDICATOR LAMP OPERATION (DRIVE LAMP ON)	
• Ignition OFF.	**Yes** INSTALL a new RCM. REFER to

• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • **Is the indicator lamp on?**	Restraints Control Module (RCM) in this section. GO to B6 . **No** REPAIR circuit 31S-JA14 (BK/GN). GO to B6 .
B5 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B1869 retrieved during the on-demand self test?**	**Yes** GO to B2 . **No** CHECK for causes of intermittent open or short to ground on circuit 31S-JA14 (BK/GN). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to B6 .
B6 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step B1. • **Were any continuous DTCs retrieved during Step B1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test C: DTC B1870 — Air Bag Warning Indicator Circuit Short to Battery

Normal Operation

If the restraints control module detects a short to battery on the air bag warning indicator circuit, it will store diagnostic trouble code (DTC) B1870 in memory. If any other DTCs are detected with this DTC active, the secondary air bag warning will be activated.

Possible Causes

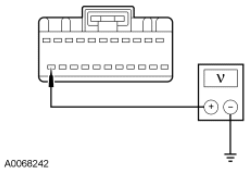
An air bag indicator circuit short to battery can be caused by:

- damaged wiring, terminals or connectors.
- a faulted RCM.

PINPOINT TEST C: DTC B1870 — AIR BAG INDICATOR CIRCUIT SHORT TO BATTERY

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
C1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B1870 retrieved during the on-demand self test?**	**Yes** GO to C2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to C4 .
C2 CHECK CIRCUIT 31S-JA14 (BK/GN) FOR A SHORT TO BATTERY	

• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Instrument Cluster Module C220a. • Disconnect: RCM C310a. • Disconnect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure the voltage between C220a-22, circuit 31S-JA14 (BK/GN), harness side and ground.  A0068242 • **Is the voltage less than 0.2 volt?**	**Yes** GO to C3 . **No** REPAIR circuit 31S-JA14 (BK/GN). GO to C5 .
C3 CHECK THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: RCM C310a. • Connect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **NOTE:** DTC B1869 should be retrieved when carrying out the on-demand self test due to an open on circuit 31S-JA14 (BK/GN), DTC B1870 should not be retrieved at this time. • **Was DTC B1870 retrieved during the on-demand self test?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to C5 . **No** REPAIR or INSTALL a new instrument cluster module. REFER to Section 413-01 . GO to C5 .
C4 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B1870 retrieved during the on-demand self test?**	**Yes** CHECK for causes of intermittent short to battery on circuit 31S-JA14 (BK/GN). REPAIR any intermittent concerns found. If an intermittent concern **was** found and repaired, GO to C5 . If an intermittent concern **was not** found and repaired, GO to C2 . **No** CHECK for causes of intermittent

	short to battery on circuit 31S-JA14 (BK/GN). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire bundle. REPAIR any intermittent concerns found. GO to C5 .
C5 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step C1. • **Were any continuous DTCs retrieved during Step C1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test D: DTC B1891 — Air Bag Tone Warning Indicator Circuit Short to Battery

Normal Operation

The restraints control module (RCM) monitors its connection to the instrument cluster module at C310a pin 22. This connection is used to signal a chime if the air bag indicator is inoperative and another SRS fault exists. If the RCM detects a short to battery on the connection to the instrument cluster module, it will store diagnostic trouble code (DTC) B1891 in memory.

Possible Causes

An air bag tone warning circuit short to battery or ignition can be caused by:

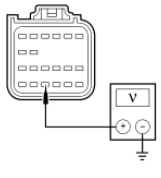
- damaged wiring, terminals or connectors.
- a damaged or inoperative instrument cluster module.
- a faulted RCM.

PINPOINT TEST D: DTC B1891 — AIR BAG TONE WARNING INDICATOR CIRCUIT SHORT TO BATTERY

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
D1 CHECK FOR A HARD OR INTERMITTENT DTC	

⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B1891 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to D2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to D4 .
D2 CHECK THE AIR BAG TONE WARNING INDICATOR CIRCUIT FOR A SHORT TO BATTERY	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310a. • Disconnect: Instrument Cluster Module C220a. • Ignition ON. • Measure the voltage between RCM C310a-22, circuit 8-GE52 (WH/BK), harness side and ground.	**Yes** GO to D3 . **No** REPAIR circuit 8-GE52 (WH/BK). GO to D5 .

 A0049254 • **Is the voltage less than 0.2 volt?**	
D3 CHECK THE AIR BAG TONE WARNING INDICATOR CIRCUIT	
• Ignition OFF. • Connect: RCM C310a. • Ignition ON. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **NOTE:** DTC 1892 should be retrieved when carrying out the on-demand self test due to an open circuit 8-GE52 (WH/BK), DTC 1891 should not be retrieved at this time. • **Was DTC B1891 retrieved during the on-demand self test?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to D5 . **No** INSTALL a new instrument cluster module. REFER to Section 413-01 . GO to D5 .
D4 CHECK FOR AN INTERMITTENT FAULT	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B1891 retrieved during the on-demand self test?**	**Yes** GO to D2 . **No** CHECK for causes of intermittent short to voltage on circuit 8-GE52 (WH/BK). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to D5 .
D5 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step D1. • **Were any continuous DTCs retrieved during Step D1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system.

	CLEAR all DTCs.

Pinpoint Test E: LFC 53/DTC B1892 — Air Bag Tone Warning Indicator Circuit Short to Ground or Open

Normal Operation

The restraints control module (RCM) monitors its connection to the instrument cluster module at C310a pin 22. This connection is used to signal a chime if the air bag indicator is inoperative and another SRS fault exists. If the RCM detects a short to ground or open on the connection to the cluster, it will store diagnostic trouble code (DTC) B1892 in memory and flash lamp fault code (LFC) 53 (or a higher priority code if one exists) on the air bag indicator.

Possible Causes

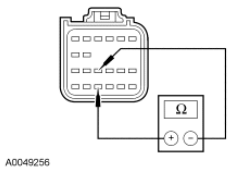
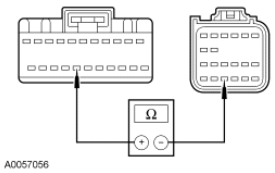
An air bag tone warning indicator circuit short to ground or open can be caused by:

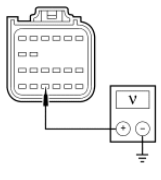
- damaged wiring, terminals or connectors.
- a damaged or inoperative instrument cluster module.
- a faulted RCM.

PINPOINT TEST E: LFC 53/DTC B1892 — AIR BAG TONE WARNING INDICATOR CIRCUIT SHORT TO GROUND OR OPEN

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
E1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to E2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to E5 .

side air curtain deployment. **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B1892 retrieved during the on-demand self test?**	
E2 CHECK THE AIR BAG TONE WARNING INDICATOR CIRCUIT FOR A GROUND SHORT	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310a. • Disconnect: Instrument Cluster Module C220a. • Measure the resistance between RCM C310a-22, circuit 8-GE52 (WH/BK), harness side and RCM C310a-16, circuit 31-JA10 (BK/RD), harness side.  A0049256 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to E3 . **No** REPAIR circuit 8-GE52 (WH/BK). GO to E6 .
E3 CHECK THE AIR BAG TONE WARNING INDICATOR CIRCUIT FOR AN OPEN	
• Measure the resistance between RCM C310a-22, circuit 8-GE52 (WH/BK), harness side and instrument cluster module C220a-18, circuit 8-GE52 (WH/BK), harness side.  A0057056 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to E4 . **No** REPAIR circuit 8-GE52 (WH/BK). GO to E6 .

E4 CHECK THE AIR BAG TONE WARNING INDICATOR	
• Connect: Instrument Cluster Module C220a. • Ignition ON. • Measure the voltage at RCM C310a-22, circuit 8-GE52 (WH/BK).  A0049254 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to E6 . **No** INSTALL a new instrument cluster module. REFER to Section 413-01 . GO to E6 .
E5 CHECK FOR AN INTERMITTENT FAULT	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B1892 retrieved during the on-demand self test?**	**Yes** CHECK for causes of intermittent short to ground or open on circuit 8-GE52 (WH/BK). REPAIR any intermittent concerns found. If an intermittent concern **was** found and repaired, GO to E6 . If an intermittent concern **was not** found and repaired, GO to E2 . **No** CHECK for causes of intermittent short to ground or open on circuit 8-GE52 (WH/BK). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to E6 .
E6 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step E1. • **Were any continuous DTCs retrieved during Step E1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system.

	REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test F: LFC 14/DTC B1921 — Air Bag Diagnostic Monitor Ground Circuit Open

⚠ WARNING: The tightening torque of the restraints control module (RCM) retaining bolts is critical for correct air bag supplemental restraint system (SRS) operation. Refer to Restraints Control Module (RCM) in this section for correct torque values.

NOTE: A resistance difference as low as 10 ohms may set the LFC.

Normal Operation

The restraints control module (RCM) monitors the resistance between the ground connections at the mounting bracket and the reference ground at C310a pin 16. If the RCM detects a difference in resistance, it will store diagnostic trouble code (DTC) B1921 in memory and flash lamp fault code (LFC) 14 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A resistance difference between the RCM bracket ground and harness ground can be caused by:

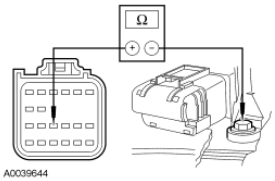
- RCM or RCM bracket not securely mounted.
- damaged wiring, terminals or connectors.
- a faulted RCM.

PINPOINT TEST F: LFC 14/DTC B1921 — AIR BAG DIAGNOSTIC MONITOR CIRCUIT OPEN

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
F1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to F2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to F5 .

⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury. **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B1921 retrieved during the on-demand self test?**	
F2 INSPECT THE RCM MOUNTING, MOUNTING BRACKET AND MOUNTING SURFACE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Inspect the RCM retainers and RCM bracket mounting bolts and make sure they are fully seated and tightened correctly. • Remove the RCM. Refer to Restraints Control Module (RCM) in this section. • Visually inspect the RCM, mounting bracket and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, or was the RCM mounting bracket attached to the mounting surface incorrectly or were the RCM bolts not fully seated and tightened correctly?**	**Yes** CLEAN and TIGHTEN the bolts. REPAIR the mounting surface as necessary. REINSTALL the RCM and mounting bracket to the mounting surface. GO to F6 . **No** GO to F3 .
F3 INSTALL THE RCM AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean the RCM mounting surfaces and bolts. • Install the RCM. Refer to Restraints Control Module (RCM) in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System	**Yes** GO to F4 . **No** CHECK for causes of intermittent high resistance on circuit 31-JA10 (BK/RD)

(SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B1921 retrieved during the on-demand self test?**	or the chassis ground. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to F6 .
F4 CHECK GROUND CIRCUIT 31-JA10 (BK/RD) FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between RCM C310a-16, circuit 31-JA10 (BK/RD), harness side and the RCM case ground.  A0039644 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to F6 . **No** REPAIR circuit 31-JA10 (BK/RD). GO to F6 .
F5 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B1921 retrieved during the on-demand self test?**	**Yes** GO to F2 . **No** CHECK for causes of intermittent high resistance on circuit 31-JA10 (BK/RD) or the chassis ground. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to F6 .
F6 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step F1. • **Were any continuous DTCs retrieved during Step F1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test G: LFC 33 and 34/DTC B2292 — Restraint System Safety Belt Pretensioner Fault

Normal Operation

The restraints control module (RCM) checks all of the safety belt pretensioners for faults. If the RCM detects 1 of the following faults on any of the safety belt pretensioner circuits, it will store diagnostic trouble code (DTC) B2292 in memory and flash, depending on the fault indicator, either lamp fault code (LFC) 33 or 34 depending on the fault (or higher priority code if one exists) on the air bag indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Low resistance
- High resistance or circuit open
- Circuit short to voltage
- Circuit short to ground

Possible Causes

A safety belt pretensioner fault can be caused by:

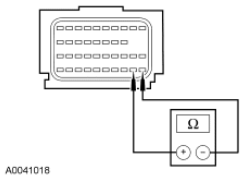
- damaged wiring, terminals or connectors.
- a faulted pretensioner.
- a faulted RCM.

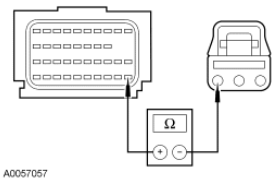
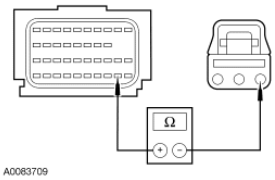
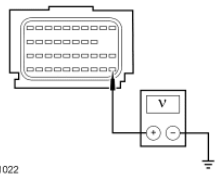
PINPOINT TEST G: LFC 33 AND 34/DTC B2292 — RESTRAINT SYSTEM SAFETY BELT PRETENSIONER FAULT

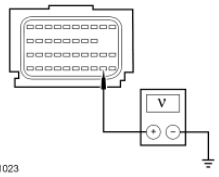
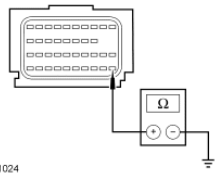
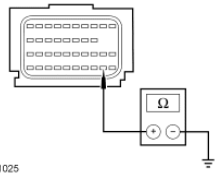
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

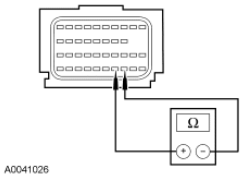
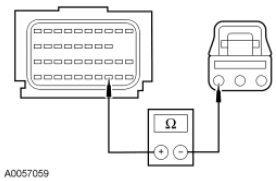
Test Step	Result / Action to Take
G1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to G2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to G18 .

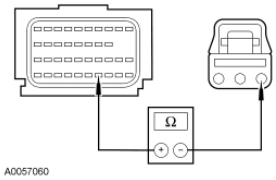
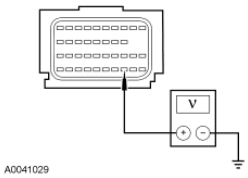
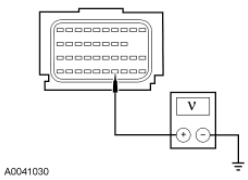
⚠ **WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2292/Record All Flagged Faults. • Enter the following diagnostic mode on the scan tool: Retrieve/Flag/Record Continuous DTCs. • **Was DTC B2292 retrieved during the on-demand self test?**	
G2 CHECK THE PRETENSIONER	
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: The Affected Safety Belt Retractor Pretensioner Electrical Connector C323 (Driver) Or C303 (Passenger). • Connect: Restraint System Diagnostic Tool 418-F088 to the Affected Safety Belt Retractor Pretensioner Electrical Connector C323 (Driver) Or C303 (Passenger). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2292 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the flagged faults recorded in the Step G1, GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded, multiple faults exist and the entire pinpoint test must be carried out. For driver safety belt retractor pretensioner with a low resistance fault, GO to G3 . For driver safety belt retractor pretensioner with an open circuit fault, GO to G4 . For driver safety belt retractor pretensioner with a short to battery fault, GO to G6 . For driver safety belt retractor pretensioner with a short to ground fault, GO to G8 . For passenger safety belt retractor pretensioner with a low resistance fault, GO to G10 .

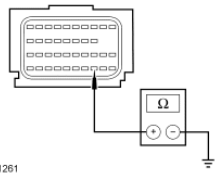
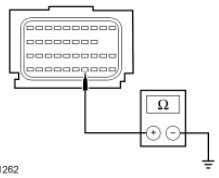
	For passenger safety belt retractor pretensioner with an open circuit fault, GO to G11 . For passenger safety belt retractor pretensioner with a short to battery fault, GO to G13 . For passenger safety belt retractor pretensioner with a short to ground fault, GO to G15 . **No** INSTALL a new driver or passenger safety belt retractor pretensioner. REFER to Section 501-20A . GO to G19 .
G3 CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT 30S-JA33 (RD/BU) AND CIRCUIT 31S-JA33 (BK/BU) FOR LOW RESISTANCE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Pretensioner Restraint System Diagnostic Tool. • Disconnect: RCM C310b. • Measure the resistance between RCM C310b-32, circuit 31S-JA33 (BK/BU), and C310b-31, circuit 30S-JA33 (RD/BU), harness side.  • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to G17 . **No** REPAIR circuit 31S-JA33 (BK/BU) and circuit 30S-JA33 (RD/BU). GO to G19 .
G4 CHECK CIRCUIT 30S-JA33 (RD/BU) FOR AN OPEN	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Pretensioner Restraint System Diagnostic Tool. • Disconnect: RCM C310b. • Measure the resistance between RCM C310b-31, circuit 30S-JA33 (RD/BU), harness side and driver safety belt retractor pretensioner C323-3, circuit 30S-JA33	**Yes** GO to G5 . **No** REPAIR circuit 30S-JA33 (RD/BU). GO to G19 .

(RD/BU), harness side.  • **Is the resistance less than 0.5 ohm?**	
G5 CHECK CIRCUIT 31S-JA33 (BK/BU) FOR AN OPEN	
• Measure the resistance between RCM C310b-32, circuit 31S-JA33 (BK/BU), harness side and driver safety belt retractor pretensioner C323-1, circuit 31S-JA33 (BK/BU), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to G17 . **No** REPAIR circuit 31S-JA33 (BK/BU). GO to G19 .
G6 CHECK CIRCUIT 30S-JA33 (RD/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: Driver Safety Belt Pretensioner Restraint System Diagnostic Tool. • Disconnect: RCM C310b. • Ignition ON. • Measure the voltage between RCM C310b-31, circuit 30S-JA33 (RD/BU), harness side and ground.  • **Is the voltage less than 0.2 volt?**	**Yes** GO to G7 . **No** REPAIR circuit 30S-JA33 (RD/BU). GO to G19 .
G7 CHECK CIRCUIT 31S-JA33 (BK/BU) FOR A SHORT TO VOLTAGE	

• Measure the voltage between RCM C310b-32, circuit 31S-JA33 (BK/BU), harness side and ground.  A0041023 • **Is the voltage less than 0.2 volt?**	**Yes** GO to G17 . **No** REPAIR circuit 31S-JA33 (BK/BU). GO to G19 .
G8 CHECK CIRCUIT 30S-JA33 (RD/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Pretensioner Restraint System Diagnostic Tool. • Disconnect: RCM C310b. • Measure the resistance between RCM C310b-31, circuit 30S-JA33 (RD/BU), harness side and ground.  A0041024 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to G9 . **No** REPAIR circuit 30S-JA33 (RD/BU). GO to G19 .
G9 CHECK CIRCUIT 31S-JA33 (BK/BU) FOR A SHORT TO GROUND	
• Measure the resistance between RCM C310b-32, circuit 31S-JA33 (BK/BU), harness side and ground.  A0041025 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to G17 . **No** REPAIR circuit 31S-JA33 (BK/BU). GO to G19 .
G10 CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT 30S-JA34 (RD/BK) AND CIRCUIT 31S-JA34 (BK/RD) FOR LOW RESISTANCE	

• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Safety Belt Pretensioner Restraint System Diagnostic Tool. • Measure the resistance between RCM C310b-34, circuit 31S-JA34 (BK/RD), and C310b-33, circuit 30S-JA34 (RD/BK), harness side.  • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to G17 . **No** REPAIR circuit 30S-JA34 (RD/BK) and circuit 31S-JA34 (BK/RD). GO to G19 .
G11 CHECK CIRCUIT 30S-JA34 (RD/BK) FOR AN OPEN	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Safety Belt Pretensioner Restraint System Diagnostic Tool. • Measure the resistance between RCM C310b-33, circuit 30S-JA34 (RD/BK), harness side and passenger safety belt retractor pretensioner C303-3, circuit 30S-JA34 (RD/BK), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to G12 . **No** REPAIR circuit 30S-JA34 (RD/BK). GO to G19 .
G12 CHECK CIRCUIT 31S-JA34 (BK/RD) FOR AN OPEN	
• Measure the resistance between RCM C310b-34, circuit 31S-JA34 (BK/RD), harness side and passenger safety belt retractor pretensioner C303-1, circuit 31S-JA34 (BK/RD), harness side.	**Yes** GO to G17 . **No** REPAIR circuit 31S-JA34 (BK/RD). GO to G19 .

 • **Is the resistance less than 0.5 ohm?**	
G13 CHECK CIRCUIT 30S-JA34 (RD/BK) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Safety Belt Pretensioner Restraint System Diagnostic Tool. • Ignition ON. • Measure the voltage between RCM C310b-33, circuit 30S-JA34 (RD/BK), harness side and ground.  • **Is the voltage less than 0.2 volt?**	**Yes** GO to G14 . **No** REPAIR circuit 30S-JA34 (RD/BK). GO to G19 .
G14 CHECK CIRCUIT 31S-JA34 (BK/RD) FOR A SHORT TO VOLTAGE	
• Measure the voltage between RCM C310b-34, circuit 31S-JA34 (BK/RD), harness side and ground.  • **Is the voltage less than 0.2 volt?**	**Yes** GO to G17 . **No** REPAIR circuit 31S-JA34 (BK/RD). GO to G19 .
G15 CHECK CIRCUIT 30S-JA34 (RD/BK) FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Safety Belt Pretensioner Restraint System Diagnostic Tool.	**Yes** GO to G16 . **No** REPAIR circuit 30S-JA34 (RD/BK). GO to G19 .

• Measure the resistance between RCM C310b-33, circuit 30S-JA34 (RD/BK), harness side and ground.  • **Is the resistance greater than 1,000,000 ohms?**	
G16 CHECK CIRCUIT 31S-JA34 (BK/RD) FOR A SHORT TO GROUND	
• Measure the resistance between RCM C310b-34, circuit 31S-JA34 (BK/RD), harness side and ground.  • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to G17 . **No** REPAIR circuit 31S-JA34 (BK/RD). GO to G19 .
G17 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Connect: Restraint System Diagnostic Tools. • Connect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2292/Record All Flagged Faults. • **Was DTC B2292 retrieved during the on-demand self test?**	**Yes** If a **"?"** was flagged by the diagnostic tool CARRY OUT the entire pinpoint test. INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to G19 . **No** CHECK for causes of the intermittent fault at or near the affected safety belt retractor pretensioner electrical connector. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found.GO to G19 .
G18 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** CHECK for causes of the intermittent fault at or near the affected safety belt retractor pretensioner electrical connector. REPAIR any intermittent concern found.

• Disconnect: The Affected Safety Belt Retractor Pretensioner Electrical Connector C323 (Driver) Or C303 (Passenger). • Connect: Restraint System Diagnostic Tool 418-F088 to the Affected Safety Belt Retractor Pretensioner Electrical Connector C323 (Driver) Or C303 (Passenger). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2292/Record All Flagged Faults. • **Was DTC B2292 retrieved during the on-demand self test?**	If an intermittent concern **was** found and repaired, GO to G19 . If an intermittent concern **was not** found and repaired, USE the flagged faults recorded and GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded, multiple faults exist and the entire pinpoint test must be carried out. For driver safety belt pretensioner with a low resistance fault, GO to G3 . For driver safety belt pretensioner with an open circuit fault, GO to G4 . For driver safety belt pretensioner with a short to battery fault, GO to G6 . For driver safety belt pretensioner with a short to ground fault, GO to G8 . For passenger safety belt pretensioner with a low resistance fault, GO to G10 . For passenger safety belt pretensioner with an open circuit fault, GO to G11 . For passenger safety belt pretensioner with a short to battery fault, GO to G11 . For passenger safety belt pretensioner with a short to ground fault, GO to G15 . **No** CHECK for causes of the intermittent fault at or near the affected safety belt retractor pretensioner electrical connector. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to G19 .
G19 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step G1.	**Yes** Do not clear any DTCs until all DTCs

• **Were any continuous DTCs retrieved during Step G1?**	have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test H: LFC 19 and 21/DTC B2293 — Restraint System - Air Bag Fault

Normal Operation

The restraints control module (RCM) checks all of the front air bag circuits for faults. If the RCM detects 1 of the following faults on any of the front air bag circuits, it will store diagnostic trouble code (DTC) B2293 in memory, and depending on the fault, flash either lamp fault code (LFC) 19 or 21 depending on the fault (or higher priority code if one exists) on the air bag indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Low resistance
- High resistance or circuit open
- Circuit short to voltage
- Circuit short to ground

Possible Causes

A driver air bag fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty clockspring.
- a faulty driver air bag module.
- a faulted RCM.

A passenger air bag fault can be caused by:

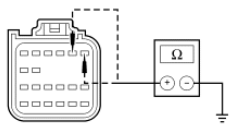
- damaged wiring, terminals or connectors.
- a faulty passenger air bag module.
- a faulted RCM.

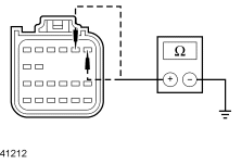
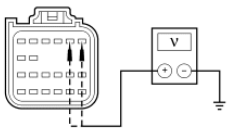
PINPOINT TEST H: LFC 19 AND 21/DTC B2293 — RESTRAINT SYSTEM - AIR BAG FAULT

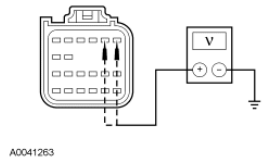
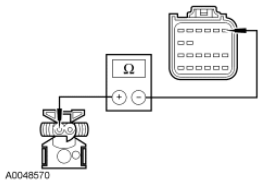
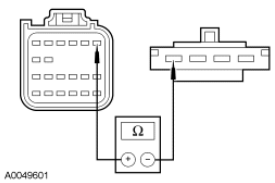
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

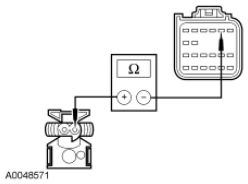
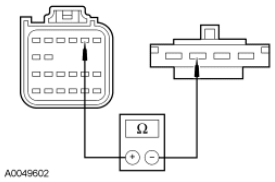
Test Step	Result / Action to Take
H1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2293/Record All Flagged Faults. • Enter the following diagnostic mode on the scan tool: Retrieve/Flag/Record Continuous DTCs. • **Was DTC B2293 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to H2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to H38 .
H2 CHECK THE DRIVER AND PASSENGER AIR BAG MODULES	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved

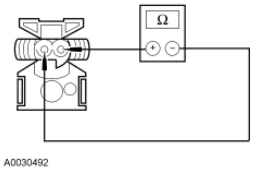
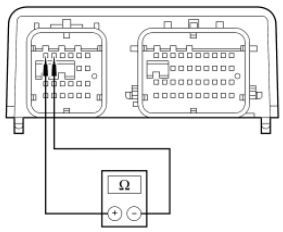
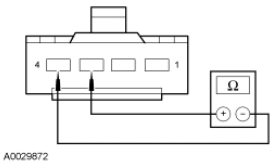
• If the flagged fault was reported for the driver air bag module: ♦ Remove the driver air bag module. Refer to Driver Air Bag Module in this section. ♦ Connect restraint system diagnostic tools 418-F395 (2 required) to the driver air bag module squib 1 and squib 2 connectors. • If the flagged fault was reported for the passenger air bag module: ♦ Disconnect the passenger air bag module C256. ♦ Connect restraint system diagnostic tool 418-F403 to passenger air bag module C256. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2293 retrieved during the on-demand self test?**	during the on-demand self test. Using the flagged faults recorded in the step H1, GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded, multiple faults exist and the entire pinpoint test must be carried out. For driver air bag module squib 1 with a short to ground fault, GO to H3 . For driver air bag module squib 1 with a short to battery fault, GO to H5 . For driver air bag module squib 1 with an open circuit fault, GO to H7 . For driver air bag module squib 1 with a low resistance fault, GO to H11 . For passenger air bag module squib 1 with a short to ground fault, GO to H14 . For passenger air bag module squib 1 with a short to battery fault, GO to H15 . For passenger air bag module squib 1 with an open circuit fault, GO to H16 . For passenger air bag module squib 1 with a low resistance fault, GO to H18 . For driver air bag module squib 2 with a short to ground fault, GO to H20 . For driver air bag module squib 2 with a short to battery fault, GO to H22 . For driver air bag module squib 2 with an open circuit fault, GO to H24 . For driver air bag module squib 2 with a low resistance fault, GO to H28 . For passenger air bag module squib 2 with a short to ground fault, GO to H31 . For passenger air bag module squib 2

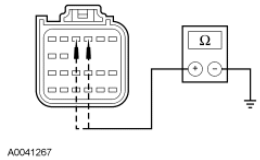
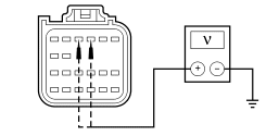
	with a short to battery fault, GO to H32 . For passenger air bag module squib 2 with an open circuit fault, GO to H33 . For passenger air bag module squib 2 with a low resistance fault, GO to H35 . **No** If a flagged fault of **"?"** was recorded in Step H1, multiple faults exist and the entire pinpoint test must be carried out. If a fault was flagged against driver air bag module in Step H1, INSTALL a new driver air bag module. REFER to Driver Air Bag Module in this section. GO to H39 . If a fault was flagged against passenger air bag module in Step H1, INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module in this section. GO to H39 .
H3 CHECK CIRCUIT 30S-JA8 (RD/OG) AND CIRCUIT 31S-JA8 (BK/OG) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Disconnect: Driver Air Bag Module Squib 1 Restraint System Diagnostic Tool. • Measure the resistance between RCM C310a-1, circuit 30S-JA8 (RD/OG), harness side and ground; and between RCM C310a-2, circuit 31S-JA8 (BK/OG), harness side and ground.  A0041212 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to H37 . **No** GO to H4 .

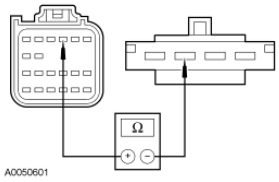
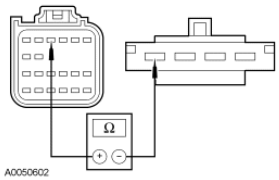
H4 CHECK CIRCUIT 30S-JA8 (RD/OG) AND CIRCUIT 31S-JA8 (BK/OG) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE CLOCKSPRING	
• Disconnect: Clockspring C218a. • Measure the resistance between RCM C310a-1, circuit 30S-JA8 (RD/OG), harness side and ground; and between RCM C310a-2, circuit 31S-JA8 (BK/OG), harness side and ground.  A0041212 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA8 (RD/OG) or circuit 31S-JA8 (BK/OG). GO to H39 .
H5 CHECK CIRCUIT 30S-JA8 (RD/OG) AND CIRCUIT 31S-JA8 (BK/OG) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: Driver Air Bag Module Squib 1 Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Ignition ON. • Measure the voltage between RCM C310a-1, circuit 30S-JA8 (RD/OG), harness side and ground; and between RCM C310a-2, circuit 31S-JA8 (BK/OG), harness side and ground.  A0041263 • **Are the voltages less than 0.2 volt?**	**Yes** GO to H37 . **No** GO to H6 .
H6 CHECK CIRCUIT 30S-JA8 (RD/OG) AND CIRCUIT 31S-JA8 (BK/OG) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND THE CLOCKSPRING	
• Ignition OFF. • Disconnect: Clockspring C218a. • Ignition ON.	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 .

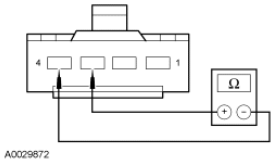
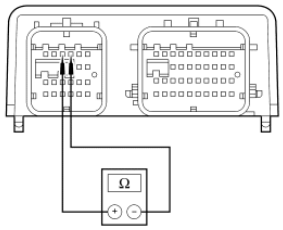
• Measure the voltage between RCM C310a-1, circuit 30S-JA8 (RD/OG), harness side and ground; and between RCM C310a-2, circuit 31S-JA8 (BK/OG), harness side and ground.  A0041263 • **Are the voltages less than 0.2 volt?**	**No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA8 (RD/OG) or 31S-JA8 (BK/OG). GO to H39 .
H7 CHECK CIRCUIT 30S-JA8 (RD/OG) AND CIRCUIT 31S-JA8 (BK/OG) FOR AN OPEN BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Air Bag Module Squib 1 Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Measure the resistance between RCM C310a-1, circuit 30S-JA8 (RD/OG), harness side and driver air bag module squib 1, circuit 30S-JA8 (GY/OG), harness side.  A0048570 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to H9 . **No** GO to H8 .
H8 CHECK CIRCUIT 30S-JA8 (RD/OG) FOR AN OPEN BETWEEN THE RCM AND THE CLOCKSPRING	
• Disconnect: Clockspring C218a. • Measure the resistance between RCM C310a-1, circuit 30S-JA8 (RD/OG), harness side and clockspring C218a-4, circuit 30S-JA8 (RD/OG), harness side.  A0049601 • **Is the resistance less than 0.5 ohm?**	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** REPAIR circuit 30S-JA8 (RD/OG). GO to H39 .

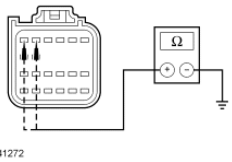
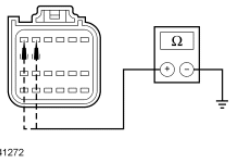
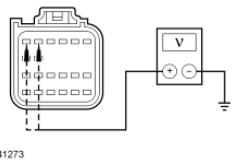
H9 CHECK CIRCUIT 31S-JA8 (BK/OG) FOR AN OPEN BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Measure the resistance between RCM C310a-2, circuit 31S-JA8 (BK/OG), harness side and driver air bag module squib 1, circuit 31S-JA8 (GY/WH), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to H37 . **No** GO to H10 .
H10 CHECK CIRCUIT 31S-JA8 (BK/OG) FOR AN OPEN BETWEEN THE RCM AND THE CLOCKSPRING	
• Disconnect: Clockspring C218a. • Measure the resistance between RCM C310a-2, circuit 31S-JA8 (BK/OG), harness side and clockspring C218a-3, circuit 31S-JA8 (BK/OG), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** REPAIR circuit 31S-JA8 (BK/OG). GO to H39 .
H11 CHECK CIRCUIT 30S-JA8 (RD/OG) AND CIRCUIT 31S-JA8 (BK/OG) FOR LOW RESISTANCE BETWEEN THE DRIVER AIR BAG MODULE AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Air Bag Module Squib 1 Restraint System Diagnostic Tool. • Measure the resistance between driver air bag module squib 1, circuit 30S-JA8 (GY/OG) and circuit 31S-JA8 (GY/WH), harness side.	**Yes** GO to H37 . **No** GO to H12 .

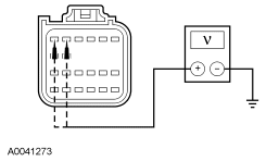
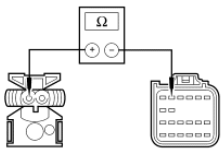
 A0030492 • **Is the resistance greater than 10,000 ohms?**	
H12 MEASURE RESISTANCE BETWEEN RCM CIRCUIT 30S-JA8 (RD/OG) AND CIRCUIT 31S-JA8 (BK/OG)	
• Disconnect: RCM C310a. • Measure the resistance between RCM C310a pin 1 and pin 2, component side.  A0041266 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H13 . **No** GO to H37 .
H13 CHECK CIRCUIT 30S-JA8 (RD/OG) AND CIRCUIT 31S-JA8 (BK/OG) FOR LOW RESISTANCE BETWEEN THE CLOCKSPRING AND THE RCM	
• Connect: RCM C310a. • Disconnect: Clockspring C218a. • Measure the resistance between clockspring C218a-4, circuit 30S-JA8 (RD/OG) and C218a-3, circuit 31S-JA8 (BK/OG), harness side.  A0029872 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** REPAIR circuit 30S-JA8 (RD/OG) and circuit 31S-JA8 (BK/OG). GO to H39 .
H14 CHECK CIRCUIT 30S-JA11 (RD/WH) AND CIRCUIT 31S-JA11 (BK/WH) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE PASSENGER AIR BAG MODULE	

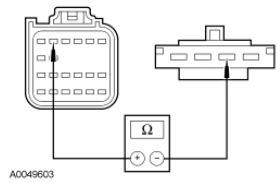
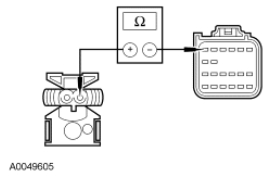
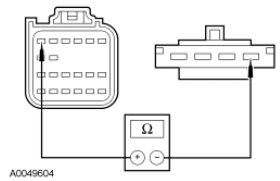
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Measure the resistance between RCM C310a-3, circuit 30S-JA11 (RD/WH), harness side and ground; and between RCM C310a-4, circuit 31S-JA11 (BK/WH), harness side and ground.  A0041267 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to H37 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA11 (RD/WH) or 31S-JA11 (BK/WH). GO to H39 .
H15 CHECK CIRCUIT 30S-JA11 (RD/WH) AND CIRCUIT 31S-JA11 (BK/WH) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND THE PASSENGER AIR BAG MODULE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: Passenger Air Bag Module Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Ignition ON. • Measure the voltage between RCM C310a-3, circuit 30S-JA11 (RD/WH), harness side and ground; and between RCM C310a-4, circuit 31S-JA11 (BK/WH), harness side and ground.  A0041268 • **Are the voltages less than 0.2 volt?**	**Yes** GO to H37 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA11 (RD/WH) or circuit 31S-JA11 (BK/WH). GO to H39 .
H16 CHECK CIRCUIT 30S-JA11 (RD/WH) FOR AN OPEN BETWEEN THE RCM AND THE PASSENGER AIR BAG MODULE	

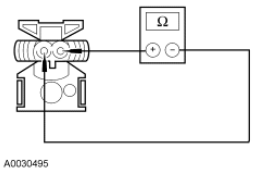
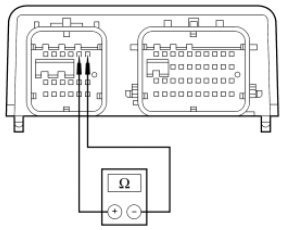
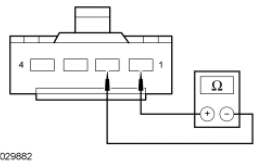
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Measure the resistance between RCM C310a-3, circuit 30S-JA11 (RD/WH), harness side and passenger air bag module C256-3, circuit 30S-JA11 (RD/WH), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to H17 . **No** REPAIR circuit 30S-JA11 (RD/WH). GO to H39 .
H17 CHECK CIRCUIT 31S-JA11 (BK/WH) FOR AN OPEN BETWEEN THE RCM AND THE PASSENGER AIR BAG MODULE	
• Measure the resistance between RCM C310a-4, circuit 31S-JA11 (BK/WH), harness side and passenger air bag module C256-4, circuit 31S-JA11 (BK/WH), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to H37 . **No** REPAIR circuit 31S-JA11 (BK/WH). GO to H39 .
H18 CHECK CIRCUIT 30S-JA11 (RD/WH) AND CIRCUIT 31S-JA11 (BK/WH) FOR LOW RESISTANCE BETWEEN THE PASSENGER AIR BAG MODULE AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module Restraint System Diagnostic Tool. • Measure the resistance between passenger air bag module C256-3, circuit 30S-JA11 (RD/WH), and C256-4, circuit 31S-JA11 (BK/WH), harness side.	**Yes** GO to H37 . **No** GO to H19 .

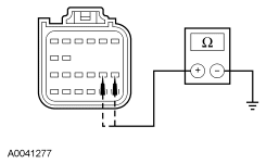
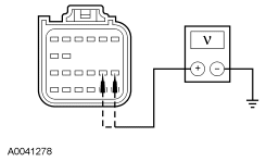
 A0029872 • **Is the resistance greater than 10,000 ohms?**	
H19 MEASURE THE RESISTANCE BETWEEN RCM CIRCUITS 30S-JA11 (RD/WH) AND CIRCUIT 31S-JA11 (BK/WH)	
• Disconnect: RCM C310a. • Measure the resistance between RCM C310a pin 3 and pin 4, component side.  A0041271 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit 30S-JA11 (RD/WH) and circuit 31S-JA11 (BK/WH). GO to H39 . **No** GO to H37 .
H20 CHECK CIRCUIT 30S-JA48 (RD/GN) AND CIRCUIT 31S-JA48 (BK/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Disconnect: Driver Air Bag Module Squib 2 Restraint System Diagnostic Tool. • Measure the resistance between RCM C310a-5, circuit 30S-JA48 (RD/GN), harness side and ground; and between RCM C310a-6, circuit 31S-JA48 (BK/GN), harness side and ground.	**Yes** GO to H37 . **No** GO to H21 .

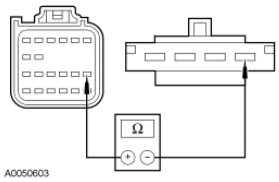
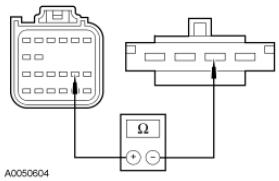
 A0041272 • **Are the resistances greater than 1,000,000 ohms?**	
H21 CHECK CIRCUIT 30S-JA48 (RD/GN) AND CIRCUIT 31S-JA48 (BK/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE CLOCKSPRING	
• Disconnect: Clockspring C218a. • Measure the resistance between RCM C310a-5, circuit 30S-JA48 (RD/GN), harness side and ground; and between RCM C310a-6, circuit 31S-JA48 (BK/GN), harness side and ground.  A0041272 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA48 (RD/GN) or 31S-JA48 (BK/GN). GO to H39 .
H22 CHECK CIRCUIT 30S-JA48 (RD/GN) AND CIRCUIT 31S-JA48 (BK/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: Driver Air Bag Module Squib 2 Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Ignition ON. • Measure the voltage between RCM C310a-5, circuit 30S-JA48 (RD/GN), harness side and ground; and between RCM C310a-6, circuit 31S-JA48 (BK/GN), harness side and ground.  A0041273 • **Are the voltages less than 0.2 volt?**	**Yes** GO to H37 . **No** GO to H23 .
H23 CHECK CIRCUIT 30S-JA48 (RD/GN) AND CIRCUIT 31S-JA48 (BK/GN) FOR A SHORT TO VOLTAGE	

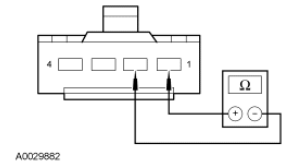
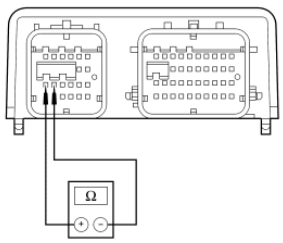
BETWEEN THE RCM AND THE CLOCKSPRING	
• Ignition OFF. • Disconnect: Clockspring C218a. • Ignition ON. • Measure the voltage between RCM C310a-5, circuit 30S-JA48 (RD/GN), harness side and ground; and between RCM C310a-6, circuit 31S-JA48 (BK/GN), harness side and ground.  A0041273 • **Are the voltages less than 0.2 volt?**	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA48 (RD/GN) or 31S-JA48 (BK/GN). GO to H39 .
H24 CHECK CIRCUIT 30S-JA48 (RD/GN) FOR AN OPEN BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Air Bag Module Squib 2 Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Measure the resistance between RCM C310a-5, circuit 30S-JA48 (RD/GN), harness side and driver air bag module squib 2, circuit 30S-JA48 (RD/BK), harness side.  A0049606 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to H26 . **No** GO to H25 .
H25 CHECK CIRCUIT 30S-JA48 (RD/GN) FOR AN OPEN BETWEEN THE RCM AND THE CLOCKSPRING	
• Disconnect: Clockspring C218a. • Measure the resistance between RCM C310a-5, circuit 30S-JA48 (RD/GN), harness side and clockspring C218a-2, circuit 30S-JA48 (RD/GN), harness side.	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** REPAIR circuit 30S-JA48 (RD/GN). GO to H39 .

 A0049603 • **Is the resistance less than 0.5 ohm?**	
H26 CHECK CIRCUIT 31S-JA48 (BK/GN) FOR AN OPEN BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Measure the resistance between RCM C310a-6, circuit 31S-JA48 (BK/GN), harness side and driver air bag module squib 2, circuit 31S-JA48 (GN/OG), harness side.  A0049605 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to H37 . **No** GO to H27 .
H27 CHECK CIRCUIT 31S-JA48 (BK/GN) FOR AN OPEN BETWEEN THE RCM AND THE CLOCKSPRING	
• Disconnect: Clockspring C218a. • Measure the resistance between RCM C310a-6, circuit 31S-JA48 (BK/GN), harness side and clockspring C218a-1, circuit 31S-JA48 (BK/GN), harness side.  A0049604 • **Is the resistance less than 0.5 ohm?**	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** REPAIR circuit 31S-JA48 (BK/GN). GO to H39 .
H28 CHECK FOR LOW RESISTANCE ON CIRCUITS 30S-JA48 (RD/GN) AND 31S-JA48 (BK/GN) BETWEEN THE RCM AND THE DRIVER AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Air Bag Module Squib 2 Restraint System Diagnostic Tool. • Measure the resistance between the driver air bag module squib 2, circuit 30S-JA48 (RD/BK), harness side and circuit 31S-JA48 (GN/OG), harness side.	**Yes** GO to H37 . **No** GO to H29 .

 A0030495 • **Is the resistance greater than 10,000 ohms?**	
H29 MEASURE THE RESISTANCE BETWEEN THE RCM CIRCUIT 30S-JA48 (RD/GN) AND CIRCUIT 31S-JA48 (BK/GN)	
• Disconnect: RCM C310a. • Measure the resistance between RCM C310a pin 5 and pin 6, component side.  A0041276 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H30 . **No** GO to H37 .
H30 CHECK FOR LOW RESISTANCE ON CIRCUIT 30S-JA48 (RD/GN) AND CIRCUIT 31S-JA48 (BK/GN) BETWEEN THE DRIVER AIR BAG MODULE AND THE CLOCKSPRING	
• Connect: RCM C310a. • Disconnect: Clockspring C218a. • Measure the resistance between clockspring C218a-1, circuit 30S-JA48 (RD/GN), harness side and C218a-2, circuit 31S-JA48 (BK/GN), harness side.  A0029882 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to H39 . **No** REPAIR circuit 30S-JA48 (RD/GN) and circuit 31S-JA48 (BK/GN). GO to H39 .
H31 CHECK CIRCUIT 30S-JA32 (RD/YE) AND CIRCUIT 31S-JA32 (BK/YE) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE PASSENGER AIR BAG	

MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Measure the resistance between RCM C310a-13, circuit 30S-JA32 (RD/YE), harness side and ground; and between RCM C310a-14, circuit 31S-JA32 (BK/YE), harness side and ground.  A0041277 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to H37 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA32 (RD/YE) or circuit 31S-JA32 (BK/YE). GO to H39 .
H32 CHECK CIRCUIT 30S-JA32 (RD/YE) AND CIRCUIT 31S-JA32 (BK/YE) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND THE PASSENGER AIR BAG MODULE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: Passenger Air Bag Module Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Ignition ON. • Measure the voltage between RCM C310a-13, circuit 30S-JA32 (RD/YE), harness side and ground; and between RCM C310a-14, circuit 31S-JA32 (BK/YE), harness side and ground.  A0041278 • **Are the voltages less than 0.2 volt?**	**Yes** GO to H37 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA32 (RD/YE) or circuit 31S-JA32 (BK/YE). GO to H39 .
H33 CHECK CIRCUIT 30S-JA32 (RD/YE) FOR AN OPEN BETWEEN THE RCM AND THE PASSENGER AIR BAG MODULE	

• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module Restraint System Diagnostic Tool. • Disconnect: RCM C310a. • Measure the resistance between RCM C310a-13, circuit 30S-JA32 (RD/YE), harness side and passenger air bag module C256-1, circuit 30S-JA32 (RD/YE), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to H34 . **No** REPAIR circuit 30S-JA32 (RD/YE). GO to H39 .
H34 CHECK CIRCUIT 31S-JA32 (BK/YE) FOR AN OPEN BETWEEN THE RCM AND THE PASSENGER AIR BAG MODULE	
• Measure the resistance between RCM C310a-14, circuit 31S-JA32 (BK/YE), harness side and passenger air bag module C256-2, circuit 31S-JA32 (BK/YE), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to H37 . **No** REPAIR circuit 31S-JA32 (BK/YE). GO to H39 .
H35 CHECK FOR LOW RESISTANCE ON CIRCUIT 30S-JA32 (RD/YE) AND CIRCUIT 31S-JA32 (BK/YE) BETWEEN THE RCM AND THE PASSENGER AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module Restraint System Diagnostic Tool. • Measure the resistance between passenger air bag module C256-1, circuit 30S-JA32 (RD/YE), harness side and C256-2, circuit 31S-JA32 (BK/YE), harness side.	**Yes** GO to H37 . **No** GO to H36 .

 A0029882 • **Is the resistance greater than 10,000 ohms?**	
H36 MEASURE THE RESISTANCE BETWEEN THE RCM CIRCUIT 30S-JA32 (RD/YE) AND CIRCUIT 31S-JA32 (BK/YE)	
• Disconnect: RCM C310a. • Measure the resistance between RCM C310a pin 13 and pin 14, component side.  A0041281 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit 30S-JA32 (RD/YE) and circuit 31S-JA32 (BK/YE). GO to H39 . **No** GO to H37 .
H37 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded • Ignition OFF. • Connect: Restraint System Diagnostic Tools. • Connect: RCM C310a. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2293/Record All Flagged Faults. • **Was DTC B2293 retrieved during the on-demand self test?**	**Yes** If a **"?"** was flagged by the diagnostic tool, CARRY OUT the entire pinpoint test. INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to H39 . **No** CHECK for causes of the intermittent fault at or near the affected air bag module connector. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to H39 .
H38 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF.	**Yes** CHECK for causes of the intermittent fault at or near the affected air bag

• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • If the flagged fault was reported for the driver air bag module: ♦ Remove the driver air bag module. Refer to Driver Air Bag Module in this section. ♦ Connect restraint system diagnostic tools 418-F395 (2 required) to the driver air bag module squib 1 and squib 2 connectors. • If the flagged fault was reported for the passenger air bag module: ♦ Disconnect the passenger air bag module C256. ♦ Connect restraint system diagnostic tool 418-F403 to passenger air bag module C256. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2293/Record All Flagged Faults. • **Was the DTC B2293 retrieved during the on-demand self test?**	module connector. REPAIR any intermittent concerns found. If an intermittent concern **was** found and repaired, GO to H39 . If an intermittent concern **was not** found and repaired, USE the flagged faults recorded and GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded multiple faults exist and the entire pinpoint test must be carried out. For driver air bag module squib 1 with a short to ground fault, GO to H3 . For driver air bag module squib 1 with a short to battery fault, GO to H5 . For driver air bag module squib 1 with an open circuit fault, GO to H7 . For driver air bag module squib 1 with a low resistance fault, GO to H11 . For passenger air bag module squib 1 with a short to ground fault, GO to H14 . For passenger air bag module squib 1 with a short to battery fault, GO to H15 . For passenger air bag module squib 1 with an open circuit fault, GO to H16 . For passenger air bag module squib 1 with a low resistance fault, GO to H18 . For driver air bag module squib 2 with a short to ground fault, GO to H20 . For driver air bag module squib 2 with a short to battery fault, GO to H22 . For driver air bag module squib 2 with an open circuit fault, GO to H24 . For driver air bag module squib 2 with a low resistance fault, GO to H28 .

	For passenger air bag module squib 2 with a short to ground fault, GO to H31 . For passenger air bag module squib 2 with a short to battery fault, GO to H32 . For passenger air bag module squib 2 with an open circuit fault, GO to H33 . For passenger air bag module squib 2 with a low resistance fault, GO to H35 . **No** CHECK for causes of the intermittent fault at or near the affected air bag module connector. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to H39 .
H39 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step H1. • **Were any continuous DTCs retrieved during Step H1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test I: LFC 24 and 25/DTC B2294 — Restraint System — Side Air Curtain Module Fault

Normal Operation

The restraints control module (RCM) checks all side air curtain module circuits for faults. If the RCM detects 1 of the following faults on any of the side air curtain module circuits, it will store diagnostic trouble code (DTC) B2294 in memory and flash, depending on the fault, either lamp fault code (LFC) 24 or 25 depending

on the fault (or higher priority code if one exists) on the air bag indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Low resistance
- Circuit open
- Circuit short to voltage
- Circuit short to ground

Possible Causes

A side air curtain module fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty side air curtain module.
- a faulted RCM.
- a faulty side air curtain bridge resistor

PINPOINT TEST I: LFC 24 AND 25/DTC B2294 — RESTRAINT SYSTEM — SIDE AIR CURTAIN MODULE FAULT

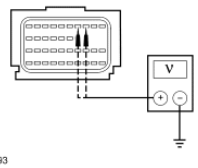
NOTE: Side air curtain bridge resistor connectors and side air curtain module connectors are similar in appearance, the difference is in the way the connectors are keyed.

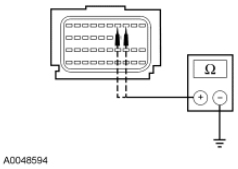
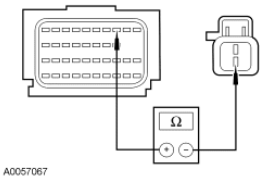
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

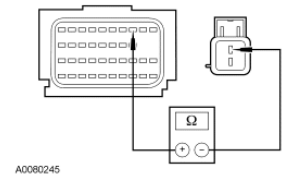
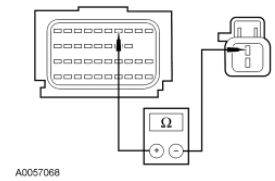
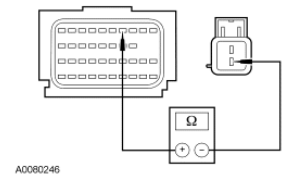
Test Step	Result / Action to Take
I1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in**	**Yes** **Vehicles with side air curtain modules** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to I3 . **Vehicles without side air curtain modules** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to I2 . **No**

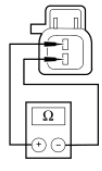
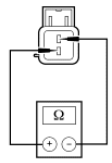
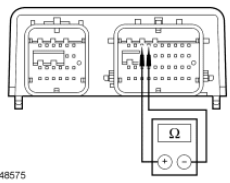
side air curtain deployment. **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag B2294/Record All Flagged Faults. • Enter the following diagnostic mode on the scan tool: Retrieve/Flag/Record Continuous DTCs. • **Was DTC B2294 retrieved during the on-demand self test?**	This is an intermittent fault. The fault condition is not present at this time. GO to I17 .
I2 CHECK THE SIDE AIR CURTAIN MODULE BRIDGE RESISTOR	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver and Passenger Side Air Curtain Bridge Resistor. • Transfer the driver side air curtain bridge resistor to the passenger side and passenger side air curtain bridge resistor to the driver side. • Connect: Driver and Passenger Side Air Curtain Bridge Resistor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2294/Record All Flagged Faults. • **Did the flagged fault transfer between the driver side and passenger side?**	**Yes** INSTALL a new side air curtain bridge resistor. GO to I18 . **No** Using the flagged faults recorded in Step I1, GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded in Step I1, multiple faults exist and the entire pinpoint test must be carried out. For driver side air curtain module with a short to battery fault, GO to I4 . For driver side air curtain module with a short to ground fault, GO to I5 . For driver side air curtain module with an open circuit fault, GO to I6 . For driver side air curtain module with a low resistance fault, GO to I8 . For passenger side air curtain module with a short to battery fault, GO to I10 . For passenger side air curtain module with a short to ground fault, GO to I11 . For passenger side air curtain module

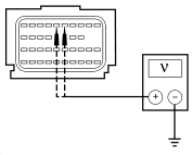
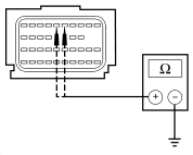
	with an open circuit fault, GO to I12 . For passenger side air curtain module with a low resistance fault, GO to I14 .
I3 CHECK THE DRIVER AND PASSENGER SIDE AIR CURTAIN MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: The Affected Side Air Curtain Module C9006 (Driver) or C9007 (Passenger). • Connect: Restraint System Diagnostic Tool 501-097 to the Affected Side Air Curtain Module C9006 (Driver) or C9007 (Passenger). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2294/Record All Flagged Faults. • **Was DTC B2294 retrieved during the on-demand self test?**	**Yes** Using the flagged faults recorded in Step I1, GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded in Step I1, multiple faults exist and the entire pinpoint test must be carried out. For driver side air curtain module with a short to battery fault, GO to I4 . For driver side air curtain module with a short to ground (STG) fault, GO to I5 . For driver side air curtain module with an open circuit fault, GO to I6 . For driver side air curtain module with a low resistance fault, GO to I8 . For passenger side air curtain module with a short to battery fault, GO to I10 . For passenger side air curtain module with a short to ground (STG) fault, GO to I11 . For passenger side air curtain module with an open circuit fault, GO to I12 . For passenger side air curtain module with a low resistance fault, GO to I14 . **No** If a flagged fault of **"?"** was recorded in Step I1, multiple faults exist and the entire pinpoint test must be carried out. If a fault was flagged against the driver side air curtain module in Step I1, INSTALL a new driver side air

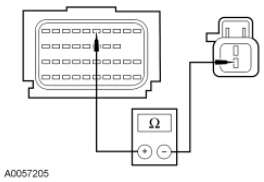
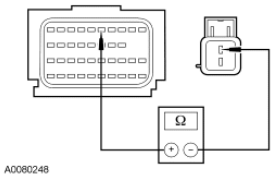
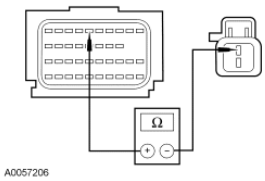
	curtain module. REFER to Side Air Curtain Module in this section. GO to I18 . If a fault was flagged against the passenger side air curtain module in Step I1, INSTALL a new passenger side air curtain module. REFER to Side Air Curtain Module in this section. GO to I18 .
I4 CHECK CIRCUIT 30S-JA50 (RD/BK) AND CIRCUIT 31S-JA50 (BK/RD) FOR A SHORT TO BATTERY BETWEEN THE RCM AND THE DRIVER SIDE AIR CURTAIN MODULE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310b. • Disconnect: Driver Side Air Curtain Module Restraint System Diagnostic Tool (with Side Air Curtain Modules). • Disconnect: Driver Side Air Curtain Bridge Resistor (without Side Air Curtain Modules). • Ignition ON. • Measure the voltage between RCM C310b-3, circuit 30S-JA50 (RD/BK), harness side and ground; and between RCM C310b-4, circuit 31S-JA50 (BK/RD), harness side and ground.  A0048593 • **Are the voltages less than 0.2 volt?**	**Yes** GO to I16 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA50 (RD/BK) or circuit 31S-JA50 (BK/RD). GO to I18 .
I5 CHECK CIRCUIT 30S-JA50 (RD/BK) AND CIRCUIT 31S-JA50 (BK/RD) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE DRIVER SIDE AIR CURTAIN MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Driver Side Air Curtain Module Restraint System Diagnostic Tool (with Side Air Curtain Modules).	**Yes** GO to I16 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA50 (RD/BK)

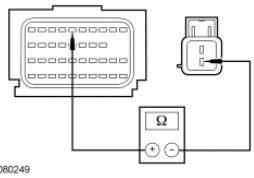
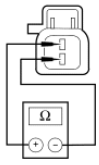
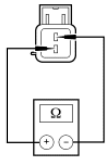
• Disconnect: Driver Side Air Curtain Bridge Resistor (without Side Air Curtain Modules). • Measure the resistance between RCM C310b-3, circuit 30S-JA50 (RD/BK), harness side and ground; and between RCM C310b-4, circuit 31S-JA50 (BK/RD), harness side and ground.  • **Are the resistances greater than 1,000,000 ohms?**	or circuit 31S-JA50 (BK/RD). GO to I18 .
I6 CHECK CIRCUIT 30S-JA50 (RD/BK) FOR AN OPEN BETWEEN THE RCM AND THE DRIVER SIDE AIR CURTAIN MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Driver Side Air Curtain Module Restraint System Diagnostic Tool (with Side Air Curtain Modules). • Disconnect: Driver Side Air Curtain Bridge Resistor (without Side Air Curtain Modules). • Vehicles without side air curtain modules, measure the resistance between RCM C310b-3, circuit 30S-JA50 (RD/BK), harness side and driver side air curtain bridge resistor C2283-2, circuit 30S-JA50 (RD/BK), harness side.  • Vehicles with side air curtain modules, measure the resistance between RCM C310b-3, circuit 30S-JA50 (RD/BK), harness side and driver side air curtain module C9006-1, circuit 30S-JA50 (RD/BK), harness side.	**Yes** GO to I7 . **No** REPAIR circuit 30S-JA50 (RD/BK). GO to I18 .

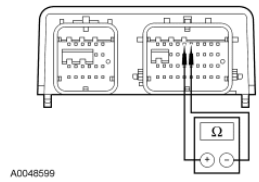
 A0080245 • **Is the resistance less than 0.5 ohm?**	
I7 CHECK CIRCUIT 31S-JA50 (BK/RD) FOR AN OPEN BETWEEN THE RCM AND THE DRIVER SIDE AIR CURTAIN MODULE	
• Vehicles without side air curtain modules, measure the resistance between RCM C310b-4, circuit 31S-JA50 (BK/RD), harness side and driver side air curtain bridge resistor C2283-1, circuit 31S-JA50 (BK/RD), harness side.  A0057068 • Vehicles with side air curtain modules, measure the resistance between RCM C310b-4, circuit 31S-JA50 (BK/RD), harness side and driver side air curtain module C9006-2, circuit 31S-JA50 (BK/RD), harness side.  A0080246 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to I16 . **No** REPAIR circuit 31S-JA50 (BK/RD). GO to I18 .
I8 CHECK FOR LOW RESISTANCE ON CIRCUIT 30S-JA50 (RD/BK) AND CIRCUIT 31S-JA50 (BK/RD) BETWEEN THE DRIVER SIDE AIR CURTAIN MODULE AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Curtain Module Restraint System Diagnostic Tool (with Side Air Curtain Modules). • Disconnect: Driver Side Air Curtain Bridge Resistor (without Side Air Curtain Modules). • Vehicles without side air curtain modules, measure the resistance between driver side air curtain bridge resistor	**Yes** GO to I16 . **No** GO to I9 .

C2283-1, circuit 31S-JA50 (BK/RD), and C2283-2, circuit 30S-JA50 (RD/BK), harness side.  A0029687 • Vehicles with side air curtain modules, measure the resistance between driver side air curtain module C9006-2, circuit 31S-JA50 (BK/RD), and C9006-1, circuit 30S-JA50 (RD/BK), harness side.  A0080247 • **Is the resistance greater than 10, 000 ohms?**	
I9 MEASURE RESISTANCE BETWEEN RCM CIRCUIT 30S-JA50 (RD/BK) AND CIRCUIT 31S-JA50 (BK/RD)	
• Disconnect: RCM C310b. • Measure the resistance between RCM C310b pin 3 and pin 4, component side.  A0048575 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit 30S-JA50 (RD/BK) and circuit 31S-JA50 (BK/RD). GO to I18 . **No** GO to I16 .
I10 CHECK CIRCUIT 30S-JA51 (RD/BU) AND CIRCUIT 31S-JA51 (BK/BU) FOR A SHORT TO BATTERY BETWEEN THE RCM AND THE PASSENGER SIDE AIR CURTAIN MODULE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Side Air Curtain Module Restraint System Diagnostic Tool (with Side Air Curtain Modules).	**Yes** GO to I16 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA51 (RD/BU)

• Disconnect: Passenger Side Air Curtain Bridge Resistor (without Side Air Curtain Modules). • Ignition ON. • Measure the voltage between RCM C310b-5, circuit 30S-JA51 (RD/BU), harness side and ground; and between RCM C310b-6, circuit 31S-JA51 (BK/BU), harness side and ground.  A0048595 • **Are the voltages less than 0.2 volt?**	or circuit 31S-JA51 (BK/BU). GO to I18 .
I11 CHECK CIRCUIT 30S-JA51 (RD/BU) AND CIRCUIT 31S-JA51 (BK/BU) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE PASSENGER SIDE AIR CURTAIN MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Side Air Curtain Module Restraint System Diagnostic Tool (with Side Air Curtain Modules). • Disconnect: Passenger Side Air Curtain Bridge Resistor (without Side Air Curtain Modules). • Measure the resistance between RCM C310b-5, circuit 30S-JA51 (RD/BU), harness side and ground; and between RCM C310b-6, circuit 31S-JA51 (BK/BU), harness side and ground.  A0048596 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to I16 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA51 (RD/BU) or circuit 31S-JA51 (BK/BU). GO to I18 .
I12 CHECK CIRCUIT 30S-JA51 (RD/BU) FOR AN OPEN BETWEEN THE RCM AND THE PASSENGER SIDE AIR CURTAIN MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b.	**Yes** GO to I13 . **No** REPAIR circuit 30S-JA51 (RD/BU). GO to I18 .

• Disconnect: Passenger Side Air Curtain Module Restraint System Diagnostic Tool (with Side Air Curtain Modules). • Disconnect: Passenger Side Air Curtain Bridge Resistor (without Side Air Curtain Modules). • Vehicles without side air curtain modules, measure the resistance between RCM C310b-5, circuit 30S-JA51 (RD/BU), harness side and passenger side air curtain bridge resistor C2284-2, circuit 30S-JA51 (RD/BU), harness side.  A0057205 • Vehicles with side air curtain modules, measure the resistance between RCM C310b-5, circuit 30S-JA51 (RD/BU), harness side and passenger side air curtain module C9007-1, circuit 30S-JA51 (RD/BU), harness side.  A0080248 • **Is the resistance less than 0.5 ohm?**	
I13 CHECK CIRCUIT 31S-JA51 (BK/BU) FOR OPEN BETWEEN THE RCM AND THE PASSENGER SIDE AIR CURTAIN MODULE	
• Vehicles without side air curtain modules, measure the resistance between RCM C310b-6, circuit 31S-JA51 (BK/BU), harness side and passenger side air curtain bridge resistor C2284-1, circuit 31S-JA51 (BK/BU), harness side.  A0057206 • Vehicles without side air curtain modules, measure the resistance between RCM C310b-6, circuit 31S-JA51 (BK/BU), harness side and passenger side air curtain module C9007-2, circuit 31S-JA51 (BK/BU), harness	**Yes** GO to I16 . **No** REPAIR circuit 31S-JA51 (BK/BU). GO to I18 .

side.  A0080249 • **Is the resistance less than 0.5 ohm?**	
I14 CHECK FOR LOW RESISTANCE ON CIRCUIT 30S-JA51 (RD/BU) AND CIRCUIT 31S-JA51 (BK/BU) BETWEEN THE PASSENGER SIDE AIR CURTAIN MODULE AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Curtain Module Restraint System Diagnostic Tool (with Side Air Curtain Modules). • Disconnect: Passenger Side Air Curtain Bridge Resistor (without Side Air Curtain Modules). • Vehicles without side air curtain modules, measure the resistance between passenger side air curtain bridge resistor C2284-2, circuit 30S-JA51 (RD/BU), and C2284-1, circuit 31S-JA51 (BK/BU), harness side.  A0029887 • Vehicles with side air curtain modules, measure the resistance between passenger side air curtain module C9007-1, circuit 30S-JA51 (RD/BU), and C9007-2, circuit 31S-JA51 (BK/BU), harness side.  A0080247 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I16 . **No** GO to I15 .
I15 MEASURE RESISTANCE BETWEEN RCM CIRCUIT 30S-JA51 (RD/BU) AND CIRCUIT 31S-JA51 (BK/BU)	

• Disconnect: RCM C310b. • Measure the resistance between RCM C310b pin 5 and pin 6, component side.  • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit 30S-JA51 (RD/BU) and circuit 31S-JA51 (BK/BU).GO to I18 . **No** GO to I16 .
I16 CONFIRM THE RCM FAULT	
• Ignition OFF. • Connect: Restraint System Diagnostic Tools (with Side Air Curtain Modules). • Connect: Side Air Curtain Bridge Resistors (without Side Air Curtain Modules). • Connect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: DTC B2294/Record All Flagged Faults. • **Was DTC B2294 retrieved during the on-demand self test?**	**Yes** If a **"?"** was flagged by the diagnostic tool, CARRY OUT the entire pinpoint test. INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to I18 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to I18 .
I17 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: The Affected Side Air Curtain Module C9006 (Driver) or C9007 (Passenger). • Connect: Restraint System Diagnostic Tool 501-097 to the Affected Side Air Curtain Module C9006 (Driver) or C9007 (Passenger). • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2294/Record All Flagged Faults. • **Was DTC B2294 retrieved during on-demand self test?**	**Yes** CHECK for causes of the intermittent fault at or near the affected side air curtain module connector. REPAIR any intermittent concerns found. If an intermittent concern **was** found and repaired, GO to I18 . If an intermittent concern **was not** found and repaired, USE the flagged faults recorded and GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded, multiple faults exist and the entire pinpoint test must be carried out. For driver side air curtain module with a short to battery fault, GO to I4 . For driver side air curtain module with a short to ground fault, GO to I5 .

	For driver side air curtain module with an open circuit fault, GO to I6 . For driver side air curtain module with a low resistance fault, GO to I8 . For passenger side air curtain module with a short to battery fault, GO to I10 . For passenger side air curtain module with a short to ground fault, GO to I11 . For passenger side air curtain module with an open circuit fault, GO to I12 . For passenger side air curtain module with a low resistance fault, GO to I14 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to I18 .
I18 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step I1. • **Were any continuous DTCs retrieved during Step I1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test J: LFC 22 and 23/DTC B2295 — Restraint System — Side Air Bag Fault

Normal Operation

The restraints control module (RCM) checks all of the seat side air bag circuits for faults. If the RCM detects 1 of the following faults on any of the seat side air bag circuits, it will store diagnostic trouble code (DTC) B2295 in memory and flash either lamp fault code (LFC) 22 or 23 depending on the fault (or higher priority code if one exists) on the air bag indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Low resistance
- High resistance or circuit open
- Circuit short to battery
- Circuit short to ground

Possible Causes

A seat side air bag status fault can be caused by:

- wiring, terminals or connectors.
- a faulty seat side air bag module.
- a faulted RCM.

PINPOINT TEST J: LFC 22 AND 23/DTC B2295 — RESTRAINT SYSTEM — SIDE AIR BAG FAULT

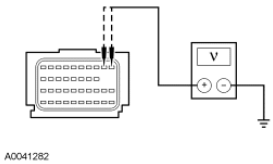
NOTE: Seat side air bag module connectors shown, seat side thorax air bag module connectors similar.

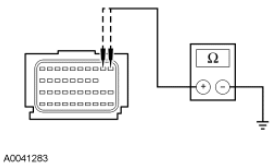
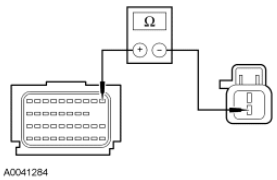
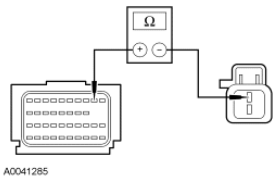
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

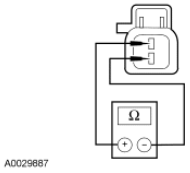
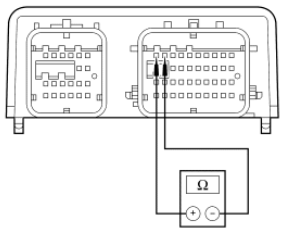
Test Step	Result / Action to Take
J1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to J2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to J26 .

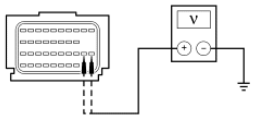
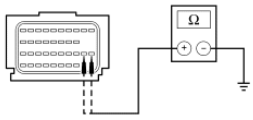
⚠ **WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2295/Record All Flagged Faults. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B2295 retrieved during the on-demand self test?**	
J2 CHECK THE DRIVER AND PASSENGER SEAT SIDE AIR BAG MODULES	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: The Affected Seat Side Air Bag Module/Seat Side Thorax Air Bag Module C367/C3226 (Driver) or C337/C3227 (Passenger). • Connect: The Affected Seat Side Air Bag Module Restraint System Diagnostic Tool 418-133 or Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool 501-097. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2295/Record All Flagged Faults. • **Was DTC B2295 retrieved during the on-demand self test?**	**Yes** Using the flagged faults recorded in Step J1, GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded in Step J1, multiple faults exist and the entire pinpoint test must be carried out. For driver seat side air bag module or driver seat side thorax air bag module with a short to battery fault, GO to J3 . For driver seat side air bag module or driver seat side thorax air bag module with a short to ground fault, GO to J4 . For driver seat side air bag module or driver seat side thorax air bag module with an open circuit fault, GO to J5 . For driver seat side air bag module or driver seat side thorax air bag module with a low resistance fault, GO to J7 . For passenger seat side air bag module or passenger seat side thorax air bag module with a short to battery fault, GO to J9 . For passenger seat side air bag module or passenger seat side thorax air bag

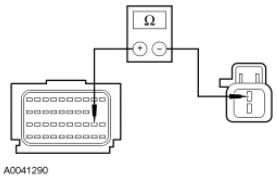
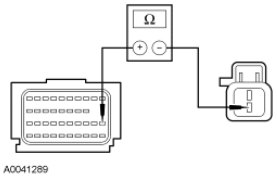
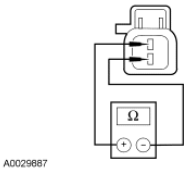
	module with a short to ground fault, GO to J10 . For passenger seat side air bag module or passenger seat side thorax air bag module with an open circuit fault, GO to J11 . For passenger seat side air bag module or passenger seat side thorax air bag module with a low resistance fault, GO to J13 . **No** Using the flagged faults recorded in Step J1, GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded in Step J1, multiple faults exist and the entire pinpoint test must be carried out. For driver seat side air bag module or driver seat side thorax air bag module with a short to battery fault, GO to J15 . For driver seat side air bag module or driver seat side thorax air bag module with a short to ground fault, GO to J16 . For driver seat side air bag module or driver seat side thorax air bag module with an open circuit fault, GO to J17 . For driver seat side air bag module or driver seat side thorax air bag module with a low resistance fault, GO to J19 . For passenger seat side air bag module or passenger seat side thorax air bag module with a short to battery fault, GO to J20 . For passenger seat side air bag module or passenger seat side thorax air bag module with a short to ground fault, GO to J21 . For passenger seat side air bag module or passenger seat side thorax air bag

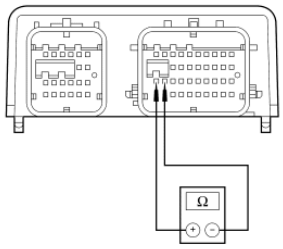
	module with an open circuit fault, GO to J22 . For passenger seat side air bag module or passenger seat side thorax air bag module with a low resistance fault, GO to J24 .
J3 CHECK CIRCUITS 30S-JA37 (RD/GN) AND 31S-JA37 (BK/GN) FOR A SHORT TO BATTERY BETWEEN THE RCM AND DRIVER SEAT SIDE AIR BAG MODULE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310b. • Disconnect: Driver Seat Side Air Bag Module or Driver Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Ignition ON. • Measure the voltage between RCM C310b-1, circuit 30S-JA37 (RD/GN), harness side and ground; and between RCM C310b-2, circuit 31S-JA37 (BK/GN), harness side and ground.  A0041282 • **Are the voltages less than 0.2 volt?**	**Yes** GO to J25 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA37 (RD/GN) or 31S-JA37 (BK/GN). GO to J27 .
J4 CHECK CIRCUITS 30S-JA37 (RD/GN) AND 31S-JA37 (BK/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SEAT SIDE AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Driver Seat Side Air Bag Module or Driver Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Measure the resistance between RCM C310b-1, circuit 30S-JA37 (RD/GN), harness side and ground; and between RCM C310b-2, circuit 31S-JA37 (BK/GN), harness side and ground.	**Yes** GO to J25 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA37 (RD/GN) or 31S-JA37 (BK/GN). GO to J27 .

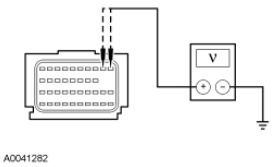
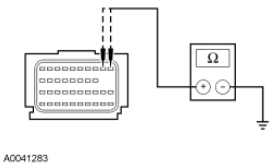
 A0041283 • **Are the resistances greater than 1,000,000 ohms?**	
J5 CHECK CIRCUIT 30S-JA37 (RD/GN) FOR A OPEN BETWEEN THE RCM AND DRIVER SEAT SIDE AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Driver Seat Side Air Bag Module or Driver Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Measure the resistance between RCM C310b-1, circuit 30S-JA37 (RD/GN), harness side and driver seat side air bag module wiring harness C316-2, circuit 30S-JA37 (RD/GN), harness side.  A0041284 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to J6 . **No** REPAIR circuit 30S-JA37 (RD/GN). GO to J27 .
J6 CHECK CIRCUIT 31S-JA37 (BK/GN) FOR AN OPEN BETWEEN THE RCM AND DRIVER SEAT SIDE AIR BAG MODULE	
• Measure the resistance between RCM C310b-2, circuit 31S-JA37 (BK/GN), harness side and driver seat side air bag wiring harness C316-1, circuit 31S-JA37 (BK/GN), harness side.  A0041285 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to J25 . **No** REPAIR circuit 31S-JA37 (BK/GN). GO to J27 .
J7 CHECK FOR LOW RESISTANCE ON CIRCUITS 30S-JA37 (RD/GN) AND BETWEEN 31S-JA37 (BK/GN) THE DRIVER SEAT SIDE AIR BAG MODULE AND RCM	

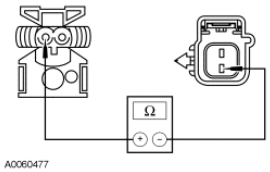
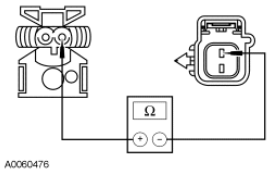
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat Side Air Bag Module or Driver Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Measure the resistance between driver seat side air bag wiring harness C316-2, circuit 30S-JA37 (RD/GN), harness side and C316-1, circuit 31S-JA37 (BK/GN), harness side.  A0029687 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to J25 . **No** GO to J8 .
J8 CHECK FOR LOW RESISTANCE BETWEEN RCM CIRCUITS 30S-JA37 (RD/GN) AND 31S-JA37 (BK/GN)	
• Disconnect: RCM C310b. • Measure the resistance between RCM C310b pin 1 and pin 2, component side.  A0041286 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit 30S-JA37 (RD/GN) and circuit 31S-JA37 (BK/GN). GO to J27 . **No** GO to J25 .
J9 CHECK CIRCUITS 30S-JA38 (RD/BK) AND 31S-JA38 (BK/RD) FOR A SHORT TO BATTERY BETWEEN THE RCM AND PASSENGER SEAT SIDE AIR BAG MODULE	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Seat Side Air Bag Module or Passenger Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool.	**Yes** GO to J25 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

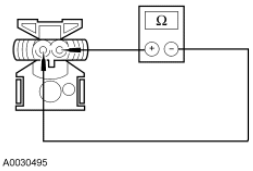
• Ignition ON. • Measure the voltage between RCM C310b-21, circuit 30S-JA38 (RD/BK), harness side and ground; and between RCM C310b-22, circuit 31S-JA38 (BK/RD), harness side and ground.  A0041287 • **Are the voltages less than 0.2 volt?**	REPAIR circuit 30S-JA38 (RD/BK) or circuit 31S-JA38 (BK/RD). GO to J27 .
J10 CHECK CIRCUITS 30S-JA38 (RD/BK) AND 31S-JA38 (BK/RD) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SEAT SIDE AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Seat Side Air Bag Module or Passenger Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Measure the resistance between RCM C310b-21, circuit 30S-JA38 (RD/BK), harness side and ground; and between RCM C310b-22, circuit 31S-JA38 (BK/RD), harness side and ground.  A0041288 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to J25 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA38 (RD/BK) or circuit 31S-JA38 (BK/RD). GO to J27 .
J11 CHECK CIRCUIT 30S-JA38 (RD/BK) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SEAT SIDE AIR BAG MODULE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Seat Side Air Bag Module or Passenger Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Measure the resistance between RCM C310b-21, circuit 30S-JA38 (RD/BK), harness side and passenger seat side	**Yes** GO to J12 . **No** REPAIR circuit 30S-JA38 (RD/BK). GO to J27 .

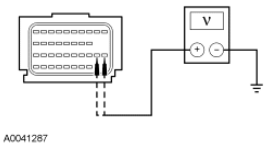
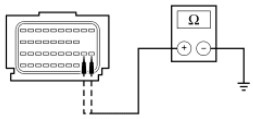
air bag wiring harness C314-2, circuit 30S-JA38 (RD/BK), harness side.  A0041290 • **Is the resistance less than 0.5 ohm?**	
J12 CHECK CIRCUIT 31S-JA38 (BK/RD) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SEAT SIDE AIR BAG MODULE	
• Measure the resistance between RCM C310b-22, circuit 31S-JA38 (BK/RD), harness side and passenger seat side air bag wiring harness C314-1, circuit 31S-JA38 (BK/RD), harness side.  A0041289 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to J25 . **No** REPAIR circuit 31S-JA38 (BK/RD). GO to J27 .
J13 CHECK FOR LOW RESISTANCE ON CIRCUITS 30S-JA38 (RD/BK) AND 31S-JA38 (BK/RD) BETWEEN THE PASSENGER SEAT SIDE AIR BAG MODULE AND RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Seat Side Air Bag Module or Passenger Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Measure the resistance between passenger seat side air bag wiring harness C314-2, circuit 30S-JA38 (RD/BK), harness side and C314-1, circuit 31S-JA38 (BK/RD), harness side.  A0029687	**Yes** GO to J25 . **No** GO to J14 .

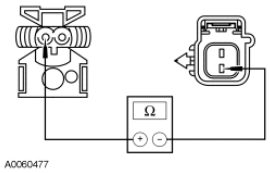
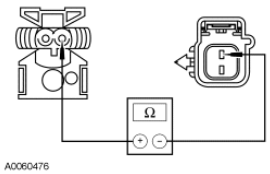
• **Is the resistance greater than 10,000 ohms?**	
J14 CHECK FOR LOW RESISTANCE BETWEEN RCM CIRCUITS 30S-JA38 (RD/BK) AND 31S-JA38 (BK/RD)	
• Disconnect: RCM C310b. • Measure the resistance between RCM C310b pin 21 and pin 22, component side.  A0041291 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit 30S-JA38 (RD/BK) and circuit 31S-JA38 (BK/RD). GO to J27 . **No** GO to J25 .
J15 CHECK CIRCUITS 30S-JA37 (RD/GN) AND 31S-JA37 (BK/GN) FOR A SHORT TO BATTERY IN THE DRIVER SEAT SIDE AIR BAG WIRING HARNESS	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310b. • Disconnect: Driver Seat Side Air Bag Module C367 or Driver Seat Side Thorax Air Bag Module C3226. • For additional information to access driver seat side air bag module C367 or driver seat side thorax air bag module C3226, refer to Side Air Bag Module in this section. • Disconnect: Driver Seat Side Air Bag Module or Driver Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Position the driver seat in the vehicle. **Do not** reactivate the system at this time. • Connect: Driver Seat Side Air Bag Wiring Harness C316. • Connect: Driver Seat Connectors. • Ignition ON. • Measure the voltage between RCM C310b-1, circuit 30S-JA37 (RD/GN), harness side and ground; and between RCM C310b-2, circuit 31S-JA37 (BK/GN), harness side and ground.	**Yes** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. CHECK for causes of the intermittent fault in circuit 31S-JA38 (BK/RD) or circuit 30S-JA38 (RD/BK) at or near passenger seat side air bag wiring harness C316 or in the driver seat side air bag harness. ATTEMPT to recreate the hard fault by flexing the wiring harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to J27 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA37 (RD/GN) or 31S-JA37 (BK/GN) between C367 or C3226 and C316. GO to J27 .

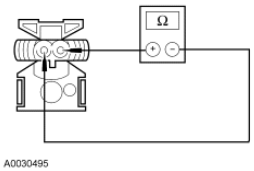
 A0041282 • **Are the voltages less than 0.2 volt?**	
J16 CHECK CIRCUITS 30S-JA37 (RD/GN) AND 31S-JA37 (BK/GN) FOR A SHORT TO GROUND IN THE DRIVER SEAT SIDE AIR BAG WIRING HARNESS	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Driver Seat Side Air Bag Module C367 or Driver Seat Side Thorax Air Bag Module C3226. • For additional information to access driver seat side air bag module C367 or C3226, refer to Side Air Bag Module in this section. • Disconnect: Driver Seat Side Air Bag Module or Driver Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Position the driver seat in the vehicle. **Do not** repower the system at this time. • Connect: Driver Seat Side Air Bag Wiring Harness C316. • Connect: Driver Seat Connectors. • Measure the resistance between RCM C310b-1, circuit 30S-JA37 (RD/GN), harness side and ground; and between RCM C310b-2, circuit 31S-JA37 (BK/GN), harness side and ground.  A0041283 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** INSTALL a new driver seat side air bag module or driver seat side thorax air bag module. GO to J27 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA37 (RD/GN) or 31S-JA37 (BK/GN) between C367 or C3226 and C316. GO to J27 .
J17 CHECK CIRCUIT 30S-JA37 (RD/GN) FOR AN OPEN IN THE DRIVER SEAT SIDE AIR BAG WIRING HARNESS	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat Side Air Bag Module C367 or Driver Seat Side Thorax Air Bag Module C3226. • For additional information to access driver seat side air bag module C367 or driver seat side thorax air bag	**Yes** GO to J18 . **No** REPAIR circuit 30S-JA37 (RD/GN). GO to J27 .

module C3226, refer to Side Air Bag Module in this section. • Measure the resistance between driver seat side air bag wiring harness C316-2, circuit 30S-JA37 (RD/GN), harness side and driver seat side air bag module C367-B or driver seat side thorax air bag module C3226-B, circuit 30S-JA37 (RD/GN), harness side.  A0060477 • **Is the resistance less than 0.5 ohm?**	
J18 CHECK CIRCUIT 31S-JA37 (BK/GN) FOR AN OPEN IN THE DRIVER SEAT SIDE AIR BAG WIRING HARNESS	
• Measure the resistance between driver seat side air bag wiring harness C316-1, circuit 31S-JA37 (BK/GN), harness side and driver seat side air bag module C367-A or driver seat side thorax air bag module C3226-A, circuit 31S-JA37 (BK/GN), harness side.  A0060476 • **Is the resistance less than 0.5 ohm?**	**Yes** INSTALL a new driver seat side air bag module or driver seat side thorax air bag module. GO to J27 . **No** REPAIR circuit 31S-JA37 (BK/GN). GO to J27 .
J19 CHECK FOR LOW RESISTANCE ON CIRCUITS 30S-JA37 (RD/GN) AND 31S-JA37 (BK/GN) IN THE DRIVER SEAT SIDE AIR BAG WIRING HARNESS	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat Side Air Bag Module C367 or Driver Seat Side Thorax Air Bag Module C3226. • For additional information to access driver seat side air bag module C367 or driver seat side thorax air bag module C3226, refer to Side Air Bag Module in this section. • Disconnect: Driver Seat Side Air Bag Module or Driver Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Position the driver seat in the vehicle. **Do not** repower the system at this time.	**Yes** INSTALL a new driver seat side air bag module or driver seat side thorax air bag module. GO to J27 . **No** REPAIR circuits 30S-JA37 (RD/GN) and 31S-JA37 (BK/GN) between C367 or C3226 and C316. GO to J27 .

• Connect: Driver Seat Side Air Bag Wiring Harness C316. • Connect: Driver Seat Connectors. • Measure the resistance between driver seat side air bag module C367-B or driver seat side thorax air bag module C3226-B, circuit 30S-JA37 (RD/GN), harness side and driver seat side air bag module C367-A or driver seat side thorax air bag module C3226-A, circuit 31S-JA37 (BK/GN), harness side.  A0030495 • **Is the resistance greater than 10,000 ohms?**	
J20 CHECK CIRCUITS 30S-JA38 (RD/BK) AND 31S-JA38 (BK/RD) FOR A SHORT TO BATTERY IN THE PASSENGER SEAT SIDE AIR BAG WIRING HARNESS	
• Ignition OFF. • Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Seat Side Air Bag Module C337 or Passenger Seat Side Thorax Air Bag Module C3227. • For additional information to access passenger seat side air bag module C337 or passenger seat side thorax air bag module C3227, refer to Side Air Bag Module in this section. • Disconnect: Passenger Seat Side Air Bag Module or Passenger Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Position the passenger seat in the vehicle. **Do not** reactivate the system at this time. • Connect: Passenger Seat Side Air Bag Wiring Harness C314. • Connect: Passenger Seat Connectors. • Ignition ON. • Measure the voltage between RCM C310b-21, circuit 30S-JA38 (RD/BK), harness side and ground; and between RCM C310b-22, circuit 31S-JA38 (BK/RD), harness side and ground.	**Yes** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. CHECK for causes of the intermittent fault in circuit 31S-JA38 (BK/RD) or circuit 30S-JA38 (RD/BK) at or near passenger seat side air bag wiring harness C314 or in the driver seat side air bag harness. ATTEMPT to recreate the hard fault by flexing the wiring harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to J27 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit 30S-JA38 (RD/BK) or 31S-JA38 (BK/RD) between C337 or C3227 and C314. GO to J27 .

 A0041287 • **Are the voltages less than 0.2 volt?**	
J21 CHECK CIRCUITS 30S-JA38 (RD/BK) AND 31S-JA38 (BK/RD) FOR A SHORT TO GROUND IN THE PASSENGER SEAT SIDE AIR BAG WIRING HARNESS	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Passenger Seat Side Air Bag Module C337 or Passenger Seat Side Thorax Air Bag Module C3227. • For additional information to access passenger seat side air bag module C337 or passenger seat side thorax air bag module C3227, refer to Side Air Bag Module in this section. • Disconnect: Passenger Seat Side Air Bag Module or Passenger Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool. • Position the passenger seat in the vehicle. **Do not** repower the system at this time. • Connect: Passenger Seat Side Air Bag Wiring Harness C314. • Connect: Passenger Seat Connectors. • Measure the resistance between RCM C310b-21, circuit 30S-JA38 (RD/BK), harness side and ground; and between RCM C310b-22, circuit 31S-JA38 (BK/RD), harness side and ground.  A0041288 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** INSTALL a new passenger seat side air bag module or passenger seat side thorax air bag module. GO to J27 . **No** Due to the shorting bar feature in the electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bars. REPAIR circuit 30S-JA38 (RD/BK) or 31S-JA38 (BK/RD) between C337 or C3227 and C314. GO to J27 .
J22 CHECK CIRCUIT 30S-JA38 (RD/BK) FOR AN OPEN IN THE PASSENGER SEAT SIDE AIR BAG WIRING HARNESS	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Seat Side Air Bag Module C337 or Passenger Seat Side Thorax Air Bag Module C3227.	**Yes** GO to J23 . **No** REPAIR circuit 30S-JA38 (RD/BK). GO to J27 .

• For additional information to access passenger seat side air bag module C337 or passenger seat side thorax air bag module C3227, refer to Side Air Bag Module in this section. • Measure the resistance between passenger seat side air bag warning harness C314-2, circuit 30S-JA38 (RD/BK), harness side and passenger seat side air bag module C337-B or passenger seat side thorax air bag module C3227-B, circuit 30S-JA38 (RD/BK), harness side.  • **Is the resistance less than 0.5 ohm?**	
J23 CHECK CIRCUIT 31S-JA38 (BK/RD) FOR AN OPEN IN THE PASSENGER SEAT SIDE AIR BAG WIRING HARNESS	
• Measure the resistance between passenger seat side air bag wiring harness C314-1, circuit 31S-JA38 (BK/RD), harness side and passenger seat side air bag module C337-A or passenger seat side thorax air bag module C3227-A, circuit 31S-JA38 (BK/RD), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** INSTALL a new passenger seat side air bag module or passenger seat side thorax air bag module. GO to J27 . **No** REPAIR circuit 31S-JA38 (BK/RD). GO to J27 .
J24 CHECK FOR LOW RESISTANCE ON CIRCUITS 30S-JA38 (RD/BK) AND 31S-JA38 (BK/RD) IN THE PASSENGER SEAT SIDE AIR BAG WIRING HARNESS	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Seat Side Air Bag Module C337 or Passenger Seat Side Thorax Air Bag Module C3227. • For additional information to access passenger seat side air bag module C337 or passenger seat side thorax air bag module C3227, refer to Side Air Bag Module in this section. • Disconnect: Passenger Seat Side Air Bag Module or Passenger Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool.	**Yes** INSTALL a new passenger seat side air bag module or passenger seat side thorax air bag module. GO to J27 . **No** REPAIR circuits 30S-JA38 (RD/BK) and 31S-JA38 (BK/RD) between C337 or C3227 and C314. GO to J27 .

• Position the passenger seat in the vehicle. **Do not** repower the system at this time. • Connect: Passenger Seat Side Air Bag Warning Harness C314. • Connect: Passenger Seat Connectors. • Measure the resistance between passenger seat side air bag module C337-B or passenger seat side thorax air bag module C3227-B, circuit 30S-JA38 (RD/BK), harness side and passenger seat side air bag module C337-A or passenger seat side thorax air bag module C3227-A, circuit 31S-JA38 (BK/RD), harness side.  A0030495 • **Is the resistance greater than 10,000 ohms?**	
J25 CONFIRM RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Connect: RCM C310b. • Connect: The Affected Seat Side Air Bag Module Restraint System Diagnostic Tool 418-133 or Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool 501-097. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2295/Record All Flagged Faults. • **Was DTC B2295 retrieved during the on-demand self test?**	**Yes** If a **"?"** was flagged by the diagnostic tool, CARRY OUT the entire pinpoint test before installing a new RCM. INSTALL a new RCM. REFER to Restraints Control Module (RCM) . GO to J27 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to J27 .
J26 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: The Affected Seat Side Air Bag Module/Seat Side Thorax Air Bag Module C367/C3226 (Driver) or C337/C3227 (Passenger).	**Yes** CHECK for causes of the intermittent fault at or near the affected seat side air bag connector. REPAIR any intermittent concerns found. If an intermittent concern **was** found and repaired, GO to J27 .

• Connect: The Affected Seat Side Air Bag Module Restraint System Diagnostic Tool 418-133 or Seat Side Thorax Air Bag Module Restraint System Diagnostic Tool 501-097. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2295/Record All Flagged Faults. • **Was DTC B2295 retrieved during the on-demand self test?**	If an intermittent concern **was not** found and repaired, USE the flagged faults recorded and GO to the appropriate pinpoint test step. If a flagged fault of **"?"** was recorded, multiple faults exist and the entire pinpoint test must be carried out. For driver seat side air bag module or driver seat side thorax air bag module with a short to battery fault, GO to J3 . For driver seat side air bag module or driver seat side thorax air bag module with a short to ground fault, GO to J4 . For driver seat side air bag module or driver seat side thorax air bag module with an open circuit fault, GO to J5 . For driver seat side air bag module or driver seat side thorax air bag module with a low resistance fault, GO to J7 . For passenger seat side air bag module or passenger seat side thorax air bag module with a short to battery fault, GO to J9 . For passenger seat side air bag module or passenger seat side thorax air bag module with a short to ground fault, GO to J10 . For passenger seat side air bag module or passenger seat side thorax air bag module with an open circuit fault, GO to J11 . For passenger seat side air bag module or passenger seat side thorax air bag module with a low resistance fault, GO to J13 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to J27 .
J27 CHECK FOR ADDITIONAL DTCs	

• Refer to the continuous DTCs recorded during Step J1. • **Were any continuous DTCs retrieved during Step J1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test K: LFC 42, 43, 44, 45 and 46/DTC B2296 — Restraint System - Impact Sensor Fault

Normal Operation

The restraints control module (RCM) checks all of the impact sensor circuits for faults. If the RCM detects 1 of the following faults on any of the impact sensor circuits, it will store diagnostic trouble code (DTC) B2296 in memory and flash either lamp fault code (LFC) 42, 43, 44, 45 or 46 depending on the fault (or higher priority code if one exists) on the air bag indicator.

Fault Conditions

The RCM monitors for the following fault conditions:

- Low resistance
- High resistance or circuit open
- Circuit short to voltage
- Circuit short to ground

Possible Causes

A impact sensor fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty impact sensor.
- incorrect sensor mounting.
- a faulted RCM.

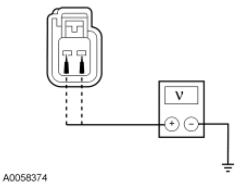
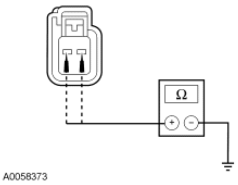
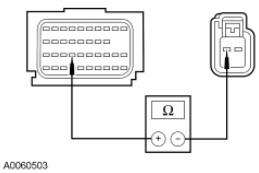
PINPOINT TEST K: LFC 42, 43, 44, 45 AND 46/DTC B2296 — RESTRAINT SYSTEM IMPACT SENSOR FAULT

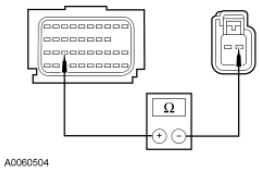
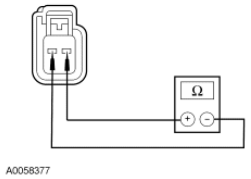
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
K1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • Enter the following diagnostic mode on the scan tool: Retrieve/Flag/Record Continuous DTCs. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. If a flagged fault of **"?"** was recorded, multiple faults exist and the entire pinpoint test must be carried out. For first row driver side impact sensor with a mounting/communications fault, GO to K2 . For first row driver side impact sensor with an internal fault, INSTALL a new first row driver side impact sensor. REFER to Side Impact Sensor — First Row, B-Pillar in this section. GO to K54 . For first row passenger side impact sensor with a mounting/communications fault, GO to K12 . For first row passenger side impact sensor with an internal fault, INSTALL a new first row passenger side impact sensor. REFER to Side Impact Sensor — First Row, B-Pillar in this section. GO to K54 . For second row driver side impact sensor with a mounting/communication fault, GO to K22 . For second row driver side impact sensor with an internal fault, INSTALL a new second row driver side impact sensor. REFER to Side Impact Sensor — Second Row, C-Pillar in this section. GO to K54 . For second row passenger side impact sensor with a mounting/communications fault, GO to K32 . For second row passenger side impact sensor with an internal fault, INSTALL a new second row passenger side impact sensor. REFER to Side Impact Sensor —

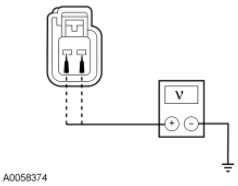
	Second Row, C-Pillar in this section. GO to K54 . For front impact severity sensor with a mounting/communications fault, GO to K42 . For front impact severity sensor with an internal fault, INSTALL a new front impact severity sensor. REFER to Front Impact Severity Sensor in this section. GO to K54 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to K53 .
K2 INSPECT THE FIRST ROW DRIVER SIDE IMPACT SENSOR MOUNTING, AND MOUNTING SURFACE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the first row driver side impact sensor. For additional information, refer to Side Impact Sensor — First Row, B-Pillar in this section. • Inspect the first row driver side impact sensor for: ♦ loose electrical connector. ♦ loose sensor mounting bolt. • Remove the first row driver side impact sensor. • Visually inspect the first row driver side impact sensor, alignment tabs, electrical connector, and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, or was the first row driver side impact sensor attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**	**Yes** CLEAN and TIGHTEN the bolt. REPAIR the mounting surface as necessary. REINSTALL the first row driver side impact sensor. GO to K54 . **No** GO to K3 .
K3 INSTALL THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the first row driver side impact sensor mounting bolt. • Install the first row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test.	**Yes** GO to K4 . **No** Fault corrected. GO to K54 .

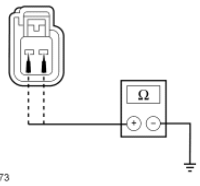
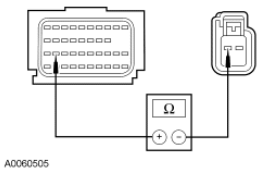
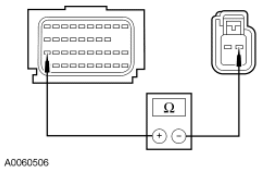
• Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	
K4 CHECK THE FIRST ROW DRIVER SIDE IMPACT SENSOR GROUND CIRCUIT 9-JA39 (BN) FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: First Row Driver Side Impact Sensor C3209. • Measure the resistance between first row driver side impact sensor C3209-1, circuit 9-JA39 (BN), harness side and the first row driver side impact sensor case ground. • **Is the resistance less than 100 ohms?**	**Yes** GO to K6 . **No** GO to K5 .
K5 CLEAN THE FIRST ROW DRIVER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST	
• Remove the first row driver side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the first row driver side impact sensor mounting bolt. • Install the first row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K6 . **No** Fault corrected. GO to K54 .
K6 CHECK CIRCUIT 7-JA39 (YE) AND CIRCUIT 9-JA39 (BN) FOR A SHORT TO VOLTAGE BETWEEN THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Disconnect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the voltage between first row driver side impact sensor C3209-1, circuit 9-JA39 (BN), harness	**Yes** GO to K7 . **No** REPAIR circuit 7-JA39 (YE) or circuit 9-JA39 (BN). GO to K54 .

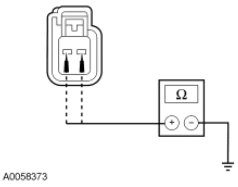
side and ground; and between C3209-2, circuit 7-JA39 (YE), harness side and ground.  A0058374 • **Are the voltages less than 0.2 volt?**	
K7 CHECK CIRCUIT 7-JA39 (YE) AND CIRCUIT 9-JA39 (BN) FOR A SHORT TO GROUND BETWEEN THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between first row driver side impact sensor C3209-1, circuit 9-JA39 (BN), harness side and ground; and between C3209-2, circuit 7-JA39 (YE), harness side and ground.  A0058373 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to K8 . **No** REPAIR circuit 7-JA39 (YE) or circuit 9-JA39 (BN). GO to K54 .
K8 CHECK CIRCUIT 7-JA39 (YE) FOR AN OPEN BETWEEN THE RCM AND THE FIRST ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-27, circuit 7-JA39 (YE), harness side and first row driver side impact sensor C3209-2, circuit 7-JA39 (YE), harness side.  A0060503 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K9 . **No** REPAIR circuit 7-JA39 (YE). GO to K54 .
K9 CHECK CIRCUIT 9-JA39 (BN) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW DRIVER	

SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-28, circuit 9-JA39 (BN), harness side and first row driver side impact sensor C3209-1, circuit 9-JA39 (BN), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K10 . **No** REPAIR circuit 9-JA39 (BN). GO to K54 .
K10 CHECK CIRCUIT 7-JA39 (YE) FOR A SHORT TO CIRCUIT 9-JA39 (BN) BETWEEN THE RCM AND THE FIRST ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between first row driver side impact sensor C3209-2, circuit 7-JA39 (YE), harness side and C3209-1, circuit 9-JA39 (BN), harness side.  • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to K11 . **No** REPAIR circuit 7-JA39 (YE) and circuit 9-JA39 (BN). GO to K54 .
K11 CHECK THE FIRST ROW DRIVER SIDE IMPACT SENSOR	
• Connect: RCM C310a. • Connect: RCM C310b. • Install a known good first row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Were any faults flagged against the first row driver side impact sensor?**	**Yes** INSTALL the original first row driver side impact sensor. GO to K52 . **No** Fault corrected. GO to K54 .
K12 INSPECT THE FIRST ROW PASSENGER SIDE IMPACT SENSOR MOUNTING, AND MOUNTING SURFACE	
• Ignition OFF.	**Yes** CLEAN and TIGHTEN the bolt.

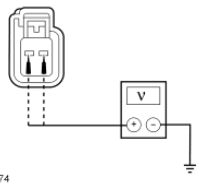
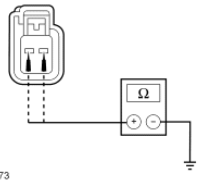
• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the first row passenger side impact sensor. For additional information, refer to Side Impact Sensor — First Row, B-Pillar in this section. • Inspect the first row passenger side impact sensor for: ♦ loose electrical connector. ♦ loose sensor mounting bolt. • Remove the first row passenger side impact sensor. • Visually inspect the first row passenger side impact sensor, alignment tabs, electrical connector, and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, or was the passenger side impact sensor attached to the mounting surface incorrectly or was the sensor bolt not fully seated and tightened correctly?**	REPAIR the mounting surface and electrical connections as necessary. REINSTALL the first row passenger side impact sensor. GO to K54 . **No** GO to K13 .
K13 INSTALL THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the first row passenger side impact sensor mounting bolt. • Install the first row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K14 . **No** Fault corrected. GO to K54 .
K14 CHECK THE FIRST ROW PASSENGER SIDE IMPACT SENSOR GROUND CIRCUIT 9-JA40 (BN/WH) FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: First Row Passenger Side Impact Sensor C3211. • Measure the resistance between first row passenger side impact sensor C3211-1, circuit 9-JA40 (BN/WH), harness side and first row passenger side impact sensor case ground. • **Is the resistance less than 100 ohms?**	**Yes** GO to K16 . **No** GO to K15 .
K15 CLEAN FIRST ROW PASSENGER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT ON-DEMAND SELF TEST	

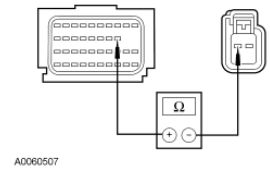
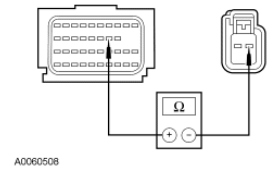
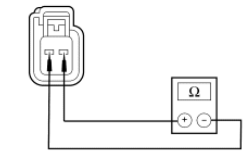
• Remove the first row passenger side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the first row passenger side impact sensor mounting bolts. • Install the first row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K16 . **No** Fault corrected. GO to K54 .
K16 CHECK CIRCUIT 7-JA40 (YE/VT) AND CIRCUIT 9-JA40 (BN/WH) FOR A SHORT TO BATTERY BETWEEN THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Disconnect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the voltage between first row passenger side impact sensor C3211-2, circuit 7-JA40 (YE/VT), harness side and ground; and between C3211-1, circuit 9-JA40 (BN/WH), harness side and ground.  A0058374 • **Are the voltages less than 0.2 volt?**	**Yes** GO to K17 . **No** REPAIR circuit 7-JA40 (YE/VT) or circuit 9-JA40 (BN/WH). GO to K54 .
K17 CHECK CIRCUIT 7-JA40 (YE/VT) AND CIRCUIT 9-JA40 (BN/WH) FOR A SHORT TO GROUND BETWEEN THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between first row passenger side impact sensor C3211-2, circuit 7-JA40 (YE/VT), harness side and ground; and between C3211-1,	**Yes** GO to K18 . **No** REPAIR circuit 7-JA40 (YE/VT) or circuit 9-JA40 (BN/WH). GO to K54 .

circuit 9-JA40 (BN/WH), harness side and ground.  • **Are the resistances greater than 1,000,000 ohms?**	
K18 CHECK CIRCUIT 7-JA40 (YE/VT) FOR AN OPEN BETWEEN THE RCM AND THE FIRST ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-29, circuit 7-JA40 (YE/VT), harness side and first row passenger side impact sensor C3211-2, circuit 7-JA40 (YE/VT), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K19 . **No** REPAIR circuit 7-JA40 (YE/VT). GO to K54 .
K19 CHECK CIRCUIT 9-JA40 (BN/WH) FOR AN OPEN BETWEEN THE RCM AND THE FIRST ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-30, circuit 9-JA40 (BN/WH), harness side and first row passenger side impact sensor C3211-1, circuit 9-JA40 (BN/WH), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K20 . **No** REPAIR circuit 9-JA40 (BN/WH). GO to K54 .
K20 CHECK CIRCUIT 7-JA40 (YE/VT) FOR A SHORT TO CIRCUIT 9-JA40 (BN/WH) BETWEEN THE RCM AND THE FIRST ROW PASSENGER SIDE IMPACT SENSOR	

• Measure the resistance between first row passenger side impact sensor C3211-2, circuit 7-JA40 (YE/VT), harness side and C3211-1, circuit 9-JA40 (BN/WH), harness side.  • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to K21 . **No** REPAIR short between circuit 7-JA40 (YE/VT) and circuit 9-JA40 (BN/WH). GO to K54 .
K21 CHECK THE FIRST ROW PASSENGER SIDE IMPACT SENSOR	
• Connect: RCM C310a. • Connect: RCM C310b. • Install a known good first row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Were any faults flagged against the first row passenger side impact sensor?**	**Yes** INSTALL the original first row passenger side impact sensor. GO to K52 . **No** Fault corrected. GO to K54 .
K22 INSPECT THE SECOND ROW DRIVER SIDE IMPACT SENSOR MOUNTING, AND MOUNTING SURFACE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the second row side impact sensor. For additional information, refer to Side Impact Sensor — Second Row, C-Pillar in his section. • Inspect the second row driver side impact sensor for: ♦ a loose electrical connector. ♦ a loose sensor mounting bolt. ♦ a loose sensor mounting bracket. • Remove the second row driver side impact sensor. • Visually inspect the second row driver side impact sensor, electrical connector, mounting bracket and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, or was the second row driver side impact sensor mounting bracket attached to the mounting surface incorrectly or was the second row driver side impact sensor bolt not fully seated and**	**Yes** CLEAN and TIGHTEN the bolt. REPAIR the mounting surface as necessary. REINSTALL the second row driver side impact sensor. GO to K54 . **No** GO to K23 .

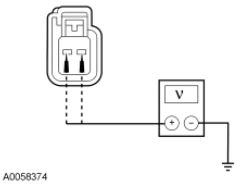
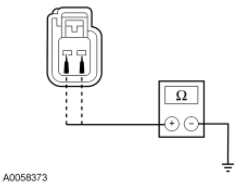
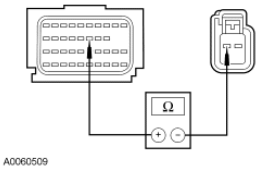
tightened correctly?	
K23 INSTALL THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the second row driver side impact sensor mounting bolt. • Install the second row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K24 . **No** Fault corrected. GO to K54 .
K24 CHECK THE SECOND ROW DRIVER SIDE IMPACT SENSOR GROUND CIRCUIT 9-JA41 (BN) FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Driver Side Impact Sensor Connector. • Measure the resistance between second row driver side impact sensor C3248-1, circuit 9-JA41 (BN), harness side and the second row driver side impact sensor case ground. • **Is the resistance less than 100 ohms?**	**Yes** GO to K26 . **No** GO to K25 .
K25 CLEAN THE SECOND ROW DRIVER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST	
• Remove the second row driver side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the second row driver side impact sensor mounting bolt. • Install the second row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K26 . **No** Fault corrected. GO to K54 .
K26 CHECK CIRCUIT 7-JA41 (YE) AND CIRCUIT 9-JA41 (BN) FOR A SHORT TO BATTERY BETWEEN	

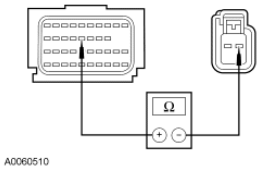
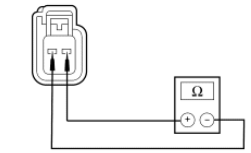
THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND THE RCM	
• Ignition ON. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Disconnect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the voltage between second row driver side impact sensor C3248-2, circuit 7-JA41 (YE), harness side and ground; and between C3248-1, circuit 9-JA41 (BN), harness side and ground.  A0058374 • **Are the voltages less than 0.2 volt?**	**Yes** GO to K27 . **No** REPAIR circuit 7-JA41 (YE) or circuit 9-JA41 (BN). GO to K54 .
K27 CHECK CIRCUIT 7-JA41 (YE) AND CIRCUIT 9-JA41 (BN) FOR A SHORT TO GROUND BETWEEN THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between second row driver side impact sensor C3248-1, circuit 9-JA41 (BN), harness side and ground; and between C3248-2, circuit 7-JA41 (YE), harness side and ground.  A0058373 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to K28 . **No** REPAIR circuit 7-JA41 (YE) or circuit 9-JA41 (BN). GO to K54 .
K28 CHECK CIRCUIT 7-JA41 (YE) FOR AN OPEN BETWEEN THE RCM AND THE SECOND ROW DRIVER SIDE IMPACT SENSOR	

• Measure the resistance between RCM C310b-13, circuit 7-JA41 (YE), harness side and second row driver side impact sensor C3248-2, circuit 7-JA41 (YE), harness side.  A0060507 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K29 . **No** REPAIR circuit 7-JA41 (YE). GO to K54 .
K29 CHECK CIRCUIT 9-JA41 (BN) FOR AN OPEN BETWEEN THE RCM AND THE SECOND ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-14, circuit 9-JA41 (BN), harness side and second row driver side impact sensor C3248-1, circuit 9-JA41 (BN), harness side.  A0060508 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K30 . **No** REPAIR circuit 9-JA41 (BN). GO to K54 .
K30 CHECK CIRCUIT 7-JA41 (YE) FOR A SHORT TO CIRCUIT 9-JA41 (BN) BETWEEN THE RCM AND SECOND ROW DRIVER SIDE IMPACT SENSOR	
• Measure the resistance between second row driver side impact sensor C3248-2, circuit 7-JA41 (YE), harness side and C3248-1, circuit 9-JA41 (BN), harness side.  A0058377 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to K31 . **No** REPAIR circuit 7-JA41 (YE) or circuit 9-JA41 (BN). GO to K54 .
K31 CHECK THE SECOND ROW DRIVER SIDE IMPACT SENSOR	
• Connect: RCM C310a. • Connect: RCM C310b.	**Yes** INSTALL the original second row driver side impact sensor. GO to K52 .

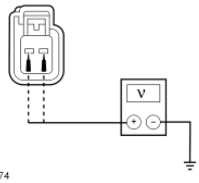
• Install a known good second row driver side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Were any faults flagged against the second row driver side impact sensor?**	**No** Fault corrected. GO to K54 .
K32 INSPECT THE SECOND ROW PASSENGER SIDE IMPACT SENSOR MOUNTING, MOUNTING BRACKET AND MOUNTING SURFACE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the second row passenger side impact sensor. For additional information, refer to Side Impact Sensor — Second Row, C-Pillar in this section. • Inspect the second row passenger side impact sensor for: ♦ loose electrical connector. ♦ loose sensor mounting bolt. • Remove the second row passenger side impact sensor. • Visually inspect the second row passenger side impact sensor, alignment tabs, electrical connector, and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, or was the second row passenger side impact sensor mounting bracket attached to the mounting surface incorrectly or were the impact sensor bolts not fully seated and tightened correctly?**	**Yes** CLEAN, TIGHTEN the bolt or REPAIR the mounting surface as necessary. REINSTALL the second row passenger side impact sensor. GO to K54 . **No** GO to K33 .
K33 INSTALL THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the second row passenger side impact sensor mounting bolt. • Install the second row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K34 . **No** Fault corrected. GO to K54 .

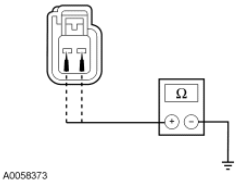
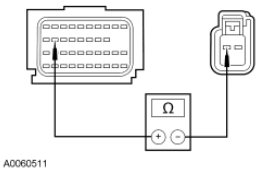
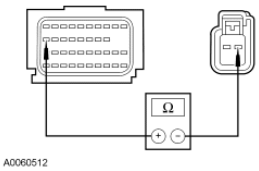
K34 CHECK THE SECOND ROW PASSENGER SIDE IMPACT SENSOR GROUND CIRCUIT 9-JA43 (BN/WH) FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Passenger Side Impact Sensor Connector. • Measure the resistance between second row passenger side impact sensor C3249-1, circuit 9-JA43 (BN/WH), harness side and the second row passenger side impact sensor case ground. • **Is the resistance less than 100 ohms?**	**Yes** GO to K36 . **No** GO to K35 .
K35 CLEAN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST	
• Remove the second row passenger side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the second row passenger side impact sensor mounting bolt. • Install the second row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K36 . **No** Fault corrected. GO to K54 .
K36 CHECK CIRCUIT 7-JA43 (YE/VT) AND CIRCUIT 9-JA43 (BN/WH) FOR A SHORT TO VOLTAGE BETWEEN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND THE RCM	
• Ignition ON. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Disconnect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the voltage between second row passenger side impact sensor C3249-2, circuit 7-JA43 (YE/VT), harness side and ground; and between C3249-1, circuit 9-JA43 (BN/WH), harness side and ground.	**Yes** GO to K37 . **No** REPAIR circuit 7-JA43 (YE/VT) or circuit 9-JA43 (BN/WH). GO to K54 .

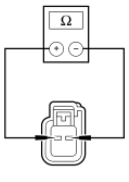
 A0058374 • **Are the voltages less than 0.2 volt?**	
K37 CHECK CIRCUIT 7-JA43 (YE/VT) AND CIRCUIT 9-JA43 (BN/WH) FOR A SHORT TO GROUND BETWEEN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND THE RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between second row passenger side impact sensor C3249-2, circuit 7-JA43 (YE/VT), harness side and ground; and between C3249-1, circuit 9-JA43 (BN/WH), harness side and ground.  A0058373 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to K38 . **No** REPAIR circuit 7-JA43 (YE/VT) or circuit 9-JA43 (BN/WH). GO to K54 .
K38 CHECK CIRCUIT 7-JA43 (YE/VT) FOR AN OPEN BETWEEN THE RCM AND THE SECOND ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between RCM C310b-15, circuit 7-JA43 (YE/VT), harness side and second row passenger side impact sensor C3249-2, circuit 7-JA43 (YE/VT), harness side.  A0060509 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K39 . **No** REPAIR circuit 7-JA43 (YE/VT). GO to K54 .
K39 CHECK CIRCUIT 9-JA43 (BN/WH) FOR AN OPEN BETWEEN THE RCM AND THE SECOND ROW PASSENGER SIDE IMPACT SENSOR	

• Measure the resistance between RCM C310b-16, circuit 9-JA43 (BN/WH), harness side and second row passenger side impact sensor C3249-1, circuit 9-JA43 (BN/WH), harness side.  A0060510 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K40 . **No** REPAIR circuit 9-JA43 (BN/WH). GO to K54 .
K40 CHECK CIRCUIT 7-JA43 (YE/VT) FOR A SHORT TO CIRCUIT 9-JA43 (BN/WH) BETWEEN THE RCM AND THE SECOND ROW PASSENGER SIDE IMPACT SENSOR	
• Measure the resistance between second row passenger side impact sensor C3249-2, circuit 7-JA43 (YE/VT), harness side and C3249-1, circuit 9-JA43 (BN/WH), harness side.  A0058377 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to K41 . **No** REPAIR circuit 7-JA43 (YE/VT) and circuit 9-JA43 (BN/WH). GO to K54 .
K41 CHECK THE SECOND ROW PASSENGER SIDE IMPACT SENSOR	
• Connect: RCM C310a. • Connect: RCM C310b. • Install a known good second row passenger side impact sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Were any faults flagged against the second row passenger side impact sensor?**	**Yes** INSTALL the original second row passenger side impact sensor. GO to K52 . **No** Fault corrected. GO to K54 .
K42 INSPECT THE FRONT IMPACT SEVERITY SENSOR MOUNTING, MOUNTING BRACKET AND MOUNTING SURFACE	
• Ignition OFF.	**Yes** CLEAN, TIGHTEN bolt or REPAIR the

• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the front impact severity sensor. For additional information, refer to Front Impact Severity Sensor in this section. • Inspect the front impact severity sensor for: ♦ loose electrical connector. ♦ loose sensor mounting bolt. • Remove the front impact severity sensor. • Visually inspect the front impact severity sensor, alignment tabs, electrical connector, and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, or was the front impact severity sensor mounting bracket attached to the mounting surface incorrectly or were the front impact severity sensor bolts not fully seated and tightened correctly?**	mounting surface as necessary. REINSTALL the front impact severity sensor. GO to K54 . **No** GO to K43 .
K43 INSTALL THE FRONT IMPACT SEVERITY SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the front impact severity sensor mounting bolt. • Install the front impact severity sensor. Refer to Front Impact Severity Sensor . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K44 . **No** Fault corrected. GO to K54 .
K44 CHECK THE FRONT IMPACT SEVERITY SENSOR GROUND CIRCUIT 9-JA49 (BN) FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Front Impact Severity Sensor C177. • Measure the resistance between front impact severity sensor C177-1, circuit 9-JA49 (BN), harness side and front impact severity sensor case ground. • **Is the resistance less than 100 ohms?**	**Yes** GO to K46 . **No** GO to K45 .
K45 CLEAN THE FRONT IMPACT SEVERITY SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST	

• Remove the front impact severity sensor. Refer to Front Impact Severity Sensor . • Clean and repair the mounting surface as necessary. • Clean the front impact severity sensor mounting bolt. • Install the front impact severity sensor. Refer to Front Impact Severity Sensor . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** GO to K46 . **No** Fault corrected. GO to K54 .
K46 CHECK CIRCUIT 7-JA49 (YE) AND CIRCUIT 9-JA49 (BN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND THE FRONT IMPACT SEVERITY SENSOR	
• Ignition ON. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Disconnect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the voltage resistance between front impact severity sensor C177-2, circuit 7-JA49 (YE), harness side and ground; and between front impact severity sensor C177-1, circuit 9-JA49 (BN), harness side and ground.  A0058374 • **Are the voltages less than 0.2 volt?**	**Yes** GO to K47 . **No** REPAIR circuit 7-JA49 (YE) or circuit 9-JA49 (BN). GO to K54 .
K47 CHECK CIRCUIT 7-JA49 (YE) AND CIRCUIT 9-JA49 (BN) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE FRONT IMPACT SEVERITY SENSOR	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** GO to K48 . **No** REPAIR circuit 7-JA49 (YE) or circuit 9-JA49 (BN). GO to K54 .

• Measure the resistance between front impact severity sensor C177-2, circuit 7-JA49 (YE), harness side and ground; and between front impact severity sensor C177-1, circuit 9-JA49 (BN), harness side and ground.  A0058373 • **Are the resistances greater than 1,000,000 ohms?**	
K48 CHECK CIRCUIT 7-JA49 (YE) FOR AN OPEN BETWEEN THE RCM AND THE FRONT IMPACT SEVERITY SENSOR	
• Measure the resistance between RCM C310b-19, circuit 7-JA49 (YE), harness side and front impact severity sensor C177-2, circuit 7-JA49 (YE), harness side.  A0060511 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K49 . **No** REPAIR circuit 7-JA49 (YE). GO to K54 .
K49 CHECK CIRCUIT 9-JA49 (BN) FOR AN OPEN BETWEEN THE RCM AND THE FRONT IMPACT SEVERITY SENSOR	
• Measure the resistance between RCM C310b-20, circuit 9-JA49 (BN), harness side and front impact severity sensor C177-1, circuit 9-JA49 (BN), harness side.  A0060512 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to K50 . **No** REPAIR circuit 9-JA49 (BN). GO to K54 .
K50 CHECK CIRCUIT 7-JA49 (YE) FOR A SHORT TO CIRCUIT 9-JA49 (BN) BETWEEN THE RCM AND THE FRONT IMPACT SEVERITY SENSOR	

• Measure the resistance between C177-2, circuit 7-JA49 (YE), harness side and front impact severity sensor C177-1, circuit 9-JA49 (BN), harness side.  A0060479 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to K51 . **No** REPAIR circuits 7-JA49 (YE) and circuit 9-JA49 (BN). GO to K54 .
K51 CHECK THE FRONT IMPACT SEVERITY SENSOR	
• Connect: RCM C310a. • Connect: RCM C310b. • Install a known good front impact severity sensor. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Were any faults flagged against the front impact severity sensor?**	**Yes** INSTALL the original front impact severity sensor. GO to K52 . **No** Fault corrected. GO to K54 .
K52 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Connect: Impact Sensors. • Connect: RCM C310a. • Connect: RCM C310b. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	**Yes** If a **"?"** was flagged by the diagnostic tool, CARRY OUT the entire pinpoint test. INSTALL a new RCM. GO to K54 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to K54 .
K53 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool:	**Yes** This is a hard fault. The fault condition is now present. The fault cannot be cleared

On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Flag DTC B2296/Record All Flagged Faults. • **Was DTC B2296 retrieved during the on-demand self test?**	until it is corrected and the DTC is no longer retrieved during the on-demand self test. If a flagged fault of **"?"** was recorded, multiple faults exist and the entire pinpoint test must be carried out. For first row driver side impact sensor with a mounting/communications fault, GO to K2 . For first row driver side impact sensor with an internal fault, INSTALL a new first row driver side impact sensor. REFER to Side Impact Sensor — First Row, B-Pillar in this section. GO to K54 . For first row passenger side impact sensor with a mounting/communications fault, GO to K12 . For first row passenger side impact sensor with an internal fault, INSTALL a new first row passenger side impact sensor. REFER to Side Impact Sensor — First Row, B-Pillar in this section. GO to K54 . For second row driver side impact sensor with a mounting/communication fault, GO to K22 . For second row driver side impact sensor with an internal fault, INSTALL a new second row driver side impact sensor. REFER to Side Impact Sensor — Second Row, C-Pillar in this section. GO to K54 . For second row passenger side impact sensor with a mounting/communications fault, GO to K32 . For second row passenger side impact sensor with an internal fault, INSTALL a new second row passenger side impact sensor. REFER to Side Impact Sensor — Second Row, C-Pillar in this section. GO to K54 . For front impact severity sensor with a mounting/communications fault, GO to

	K42 . For front impact severity sensor with an internal fault, INSTALL a new front impact severity sensor. REFER to Front Impact Severity Sensor in this section. GO to K54 . **No** VISUALLY INSPECT the affected impact sensor, mounting brackets and mounting surface for damage, corrosion or dirt. INSPECT the wiring, terminals and connectors for damage, corrosion or dirt. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. REPAIR any intermittent concerns found. GO to K54 .
K54 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step K1. • **Were any continuous DTCs retrieved during Step K1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test L: LFC 51/DTC B2434 — Driver Safety Belt Buckle Switch Circuit Short to Ground

Normal Operation

The restraints control module (RCM) checks the driver safety belt buckle switch circuits for faults. If the RCM detects a short to ground fault, it will store diagnostic trouble code (DTC) B2434 in memory and flash lamp fault code (LFC) 51 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

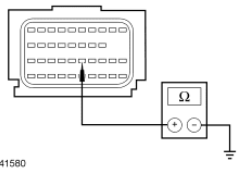
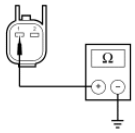
A driver safety belt buckle switch open circuit fault can be caused by:

- wiring, terminals or connectors.
- a faulty driver safety belt buckle switch.
- a faulted RCM.

PINPOINT TEST L: LFC 51/DTC B2434 — DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT SHORT TO GROUND

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
L1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B2434 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to L2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to L6 .
L2 CHECK CIRCUIT 8-JA54 (WH) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SEAT	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat C315. • Disconnect: RCM C310b.	**Yes** GO to L3 . **No** REPAIR circuit 8-JA54 (WH) in the body wiring harness. GO to L7 .

• Measure the resistance between RCM C310b-25, circuit 8-JA54 (WH), harness side and ground.  A0041580 • **Is the resistance greater than 1,000,000 ohms?**	
L3 CHECK CIRCUIT 8-JA54 (WH) FOR A SHORT TO GROUND BETWEEN THE DRIVER SAFETY BELT BUCKLE SWITCH AND GROUND	
• Connect: Driver Seat C315. • Disconnect: Driver Safety Belt Buckle Switch C3065. • Measure the resistance between driver safety belt buckle switch C3065-1, circuit 8-JA54 (WH), harness side and ground.  A0030636 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to L4 . **No** REPAIR circuit 8-JA54 (WH) in the seat wiring harness. GO to L7 .
L4 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH	
• Connect: RCM C310b. • Install a known good driver safety belt buckle. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2434 retrieved during the on-demand self test?**	**Yes** GO to L5 . **No** Fault corrected. GO to L7 .
L5 CONFIRM RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF.	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) . GO to L7 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the

• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Reinstall the original driver safety belt buckle switch. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2434 retrieved during the on-demand self test?**	wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to L7 .
L6 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2434 retrieved during the on-demand self test?**	**Yes** GO to L2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to L7 .
L7 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step L1. • **Were any continuous DTCs retrieved during Step L1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test M: LFC 51/DTC B2435 — Driver Safety Belt Buckle Switch Circuit Resistance Out of Range

Normal Operation

The restraints control module (RCM) checks the driver safety belt buckle switch circuits for faults. If the RCM detects a current out of range fault, it will store diagnostic trouble code (DTC) B2435 in memory and flash lamp fault code (LFC) 51 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

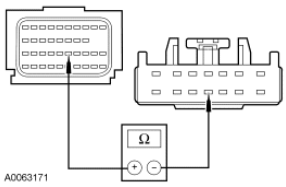
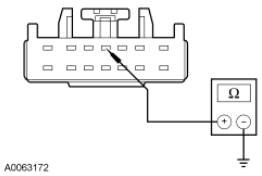
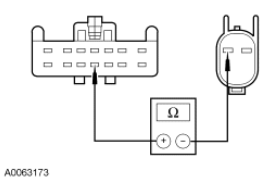
A driver safety belt buckle switch current out of range fault can be caused by:

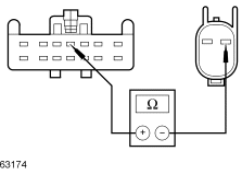
- wiring, terminals or connectors.
- a faulty driver safety belt buckle switch.
- a faulted RCM.

PINPOINT TEST M: LFC 51/DTC B2435 — DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT RESISTANCE OUT OF RANGE

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
M1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B2435 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to M2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to M8 .

M2 CHECK CIRCUIT 8-JA54 (WH) FOR AN OPEN BETWEEN THE RCM AND DRIVER SEAT	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat C315. • Disconnect: RCM C310b. • Measure the resistance between RCM C310b-25, circuit 8-JA54 (WH), harness side and driver seat C315-11, circuit 8-JA54 (WH), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to M3 . **No** REPAIR circuit 8-JA54 (WH) in the body wiring harness. GO to M9 .
M3 CHECK CIRCUIT 31-JA54 (BK/YE) FOR AN OPEN BETWEEN AND DRIVER SEAT AND GROUND	
• Measure the resistance between C315-4, circuit 31-JA54 (BK/YE), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to M4 . **No** REPAIR circuit 31-JA54 (BK/YE) in the body wiring harness. GO to M9 .
M4 CHECK CIRCUIT 8-JA54 (WH) FOR AN OPEN BETWEEN THE DRIVER SEAT AND DRIVER SAFETY BELT BUCKLE SWITCH	
• Disconnect: Driver Safety Belt Buckle Switch C3065. • Measure the resistance between driver seat C315-11, circuit 8-JA54 (WH), harness side and driver safety belt buckle switch C3065-1, circuit 8-JA54 (WH), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to M5 . **No** REPAIR circuit 8-JA54 (WH) in the seat wiring harness. GO to M9 .

M5 CHECK CIRCUIT 31-JA54 (BK/YE) FOR AN OPEN BETWEEN THE DRIVER SEAT AND DRIVER SAFETY BELT BUCKLE SWITCH	
• Measure the resistance between driver seat C315-4, circuit 31-JA54 (BK/YE), harness side and driver safety belt buckle switch C3065-2, circuit 31-JA54 (BK/YE), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to M6 . **No** REPAIR circuit 31-JA54 (BK/YE) in the seat wiring harness. GO to M9 .
M6 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH	
• Connect: RCM C310b. • Install a known good driver safety belt buckle. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2435 retrieved during the on-demand self test?**	**Yes** GO to M7 . **No** Fault corrected. GO to M9 .
M7 CONFIRM RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Reinstall the original driver safety belt buckle switch. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2435 retrieved during the on-demand self test?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) . GO to M9 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to M9 .
M8 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2435 retrieved during the on-demand self test?**	**Yes** GO to M2 . **No** CHECK for causes of the intermittent fault.

	ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to M9 .
M9 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step M1. • **Were any continuous DTCs retrieved during Step M1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test N: LFC 52/DTC B2438 — Passenger Safety Belt Buckle Switch Circuit Short to Ground

Normal Operation

The restraints control module (RCM) checks the passenger safety belt buckle switch circuits for faults. If the RCM detects a short to ground fault, it will store diagnostic trouble code (DTC) B2438 in memory and flash lamp fault code (LFC) 52 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A passenger safety belt buckle switch open circuit fault can be caused by:

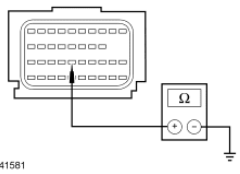
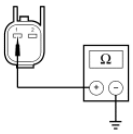
- wiring, terminals or connectors.
- a faulty passenger safety belt buckle switch.
- a faulted RCM.

PINPOINT TEST N: LFC 52/DTC B2438 — PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT SHORT TO GROUND

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
N1 CHECK FOR A HARD OR INTERMITTENT DTC	

⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B2438 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to N2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to N6 .
N2 CHECK CIRCUIT 8-JA55 (WH/BK) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SEAT	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Seat C313. • Disconnect: RCM C310b. • Measure the resistance between RCM C310b-26, circuit 8-JA55 (WH/BK), harness side and ground.	**Yes** GO to N3 . **No** REPAIR circuit 8-JA55 (WH/BK) in the body wiring harness. GO to N7 .

 A0041581 • **Is the resistance greater than 1,000,000 ohms?**	
N3 CHECK CIRCUIT 8-JA55 (WH/BK) FOR A SHORT TO GROUND BETWEEN THE PASSENGER SAFETY BELT BUCKLE SWITCH AND GROUND	
• Connect: Passenger Seat C313. • Disconnect: Passenger Safety Belt Buckle Switch C3066. • Measure the resistance between passenger safety belt buckle switch C3066-1, circuit 8-JA55 (WH/BK), harness side and ground.  A0030636 • **Is the resistance greater than 1,000,000 ohms?**	**Yes** GO to N4 . **No** REPAIR circuit 8-JA55 (WH/BK) in the seat wiring harness. GO to N7 .
N4 CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH	
• Connect: RCM C310b. • Install a known good passenger safety belt buckle. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2438 retrieved during the on-demand self test?**	**Yes** GO to N5 . **No** Fault corrected. GO to N7 .
N5 CONFIRM RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Reinstall the original passenger safety belt buckle switch. Refer to Section 501-20A .	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) . GO to N7 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to N7 .

• Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2438 retrieved during the on-demand self test?**	
N6 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2438 retrieved during the on-demand self test?**	**Yes** GO to N2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to N7 .
N7 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step N1. • **Were any continuous DTCs retrieved during Step N1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test O: LFC 52/DTC B2439 — Passenger Safety Belt Buckle Switch Circuit Resistance Out of Range

Normal Operation

The restraints control module (RCM) checks the passenger safety belt buckle switch circuits for faults. If the RCM detects a current out of range fault, it will store diagnostic trouble code (DTC) B2439 in memory and flash lamp fault code (LFC) 52 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

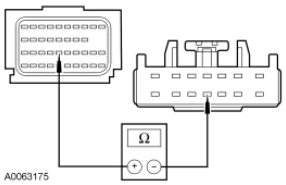
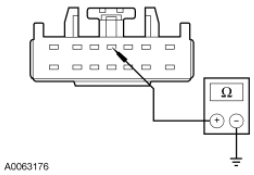
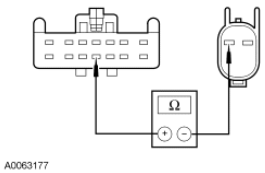
A passenger safety belt buckle switch current out of range fault can be caused by:

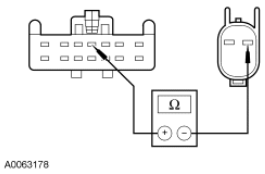
- wiring, terminals or connectors.
- a faulty passenger safety belt buckle switch.
- a faulted RCM.

PINPOINT TEST O: LFC 52/DTC B2439 — PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT RESISTANCE OUT OF RANGE

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
O1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B2439 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to O2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to O8 .
O2 CHECK FOR OPEN ON CIRCUIT 8-JA55 (WH/BK) BETWEEN RCM AND PASSENGER SEAT	

• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Seat C313. • Disconnect: RCM C310b. • Measure the resistance between RCM C310b-26, circuit 8-JA55 (WH/BK), harness side and passenger seat C313-11, circuit 8-JA55 (WH/BK), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to O3 . **No** REPAIR circuit 8-JA55 (WH/BK) in the body wiring harness. GO to O9 .
O3 CHECK CIRCUIT 31-JA55 (BK/RD) FOR AN OPEN BETWEEN THE PASSENGER SEAT AND GROUND	
• Measure the resistance between passenger seat C313-4, circuit 31-JA55 (BK/RD), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to O4 . **No** REPAIR circuit 31-JA55 (BK/RD) in the body wiring harness. GO to O9 .
O4 CHECK CIRCUIT 8-JA55 (WH/BK) FOR AN OPEN BETWEEN THE PASSENGER SEAT AND PASSENGER SAFETY BELT BUCKLE SWITCH	
• Disconnect: Passenger Safety Belt Buckle Switch C3066. • Measure the resistance between passenger seat C313-11, circuit 8-JA55 (WH/BK), harness side and passenger safety belt buckle switch C3066-1, circuit 8-JA55 (WH/BK), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to O5 . **No** REPAIR circuit 8-JA55 (WH/BK) in the seat wiring harness. GO to O9 .
O5 CHECK CIRCUIT 31-JA55 (BK/RD) FOR AN OPEN BETWEEN THE PASSENGER SEAT AND PASSENGER	

SAFETY BELT BUCKLE SWITCH	
• Measure the resistance between passenger seat C313-4, circuit 31-JA55 (BK/RD), harness side and passenger safety belt buckle switch C3066-2, circuit 31-JA55 (BK/RD), harness side.  A0063178 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to O6 . **No** REPAIR circuit 31-JA55 (BK/RD) in the seat wiring harness. GO to O9 .
O6 CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH	
• Connect: RCM C310b. • Install a known good passenger safety belt buckle. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2439 retrieved during the on-demand self test?**	**Yes** GO to O7 . **No** Fault corrected. GO to O9 .
O7 CONFIRM RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Reinstall the original passenger safety belt buckle switch. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2439 retrieved during the on-demand self test?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) . GO to O9 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to O9 .
O8 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF.	**Yes** GO to O2 .

• Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2439 retrieved during the on-demand self test?**	**No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to O9 .
O9 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step O1. • **Were any continuous DTCs retrieved during Step O1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test P: LFC 51/DTC B2691 — Driver Safety Belt Buckle Switch Circuit Fault

Normal Operation

The restraints control module (RCM) checks the driver safety belt buckle switch circuits for faults. If the RCM detects an open circuit or short to voltage fault, it will store diagnostic trouble code (DTC) B2691 in memory and flash lamp fault code (LFC) 51 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A driver safety belt buckle switch open circuit or short to voltage fault can be caused by:

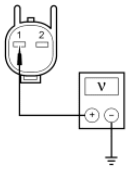
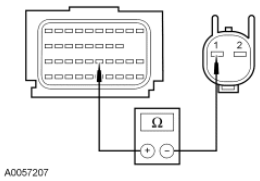
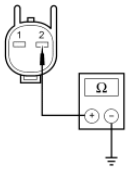
- wiring, terminals or connectors.
- a faulty driver safety belt buckle switch.
- a faulted RCM.

PINPOINT TEST P: LFC 51/DTC B2691 — DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FAULT

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
P1 CHECK FOR A HARD OR INTERMITTENT DTC	
	Yes This is a hard fault. The fault

⚠ **WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards.** ⚠ **WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** ⚠ **WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** ⚠ **WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B2691 retrieved during the on-demand self test?**	condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to P2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to P7 .
P2 CHECK CIRCUITS 8-JA54 (WH) FOR A SHORT TO BATTERY	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat Side Air Bag Module C367 or Driver Seat Side Thorax Air Bag Module C3226. • Connect: Restraint System Diagnostic Tool 418-133 to Driver Seat Side Air Bag Module C367 or Restraint System Diagnostic Tool 501-097 to Driver Seat Side Thorax Air Bag Module C3226. • Disconnect: RCM C310a. • Disconnect: RCM C310b. • Disconnect: Driver Safety Belt Buckle Switch C3065. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS)	**Yes** GO to P3 . **No** REPAIR circuit 8-JA54 (WH) in the seat wiring harness. GO to P8 .

Depowering and Repowering in this section. • Ignition ON. • Measure the voltage between driver safety belt buckle switch C3065-1, circuit 8-JA54 (WH), harness side and ground.  A0057209 • **Is the voltage less than 0.2 volt?**	
P3 CHECK CIRCUIT 8-JA54 (WH) FOR OPEN BETWEEN THE DRIVER BUCKLE SWITCH C3065 AND RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between driver buckle switch C3065-1, circuit 8-JA54 (WH), harness side and RCM C310b-25, circuit 8-JA54 (WH), harness side.  A0057207 • **Is the resistance less than 5 ohms?**	**Yes** GO to P4 . **No** REPAIR circuit 8-JA54 (WH). GO to P8 .
P4 CHECK CIRCUIT 31-JA54 (BK/YE) FOR AN OPEN	
• Measure the resistance between the driver buckle switch C3065-2, circuit 31-JA54 (BK/YE), harness side and ground.  A0057208 • **Is the resistance less than 5 ohms?**	**Yes** GO to P5 . **No** REPAIR circuit 31-JA54 (BK/YE). GO to P8 .
P5 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH	
• Connect: RCM C310b.	**Yes** GO to P6 .

• Install a known good driver safety belt buckle. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2691 retrieved during the on-demand self test?**	**No** Fault corrected. GO to P8 .
P6 CONFIRM RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Reinstall the original driver safety belt buckle switch. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2691 retrieved during the on-demand self test?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) . GO to P8 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to P8 .
P7 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2691 retrieved during the on-demand self test?**	**Yes** GO to P2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to P8 .
P8 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step P1. • **Were any continuous DTCs retrieved during Step P1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction. **No** RECONNECT the system.

	REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test Q: LFC 52/DTC B2692 — Passenger Safety Belt Buckle Switch Circuit Fault

Normal Operation

The restraints control module (RCM) checks the passenger safety belt buckle switch circuits for faults. If the RCM detects an open circuit or a short to voltage fault, it will store diagnostic trouble code (DTC) B2692 in memory and flash lamp fault code (LFC) 52 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

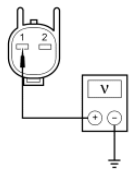
A passenger safety belt buckle switch short to battery fault can be caused by:

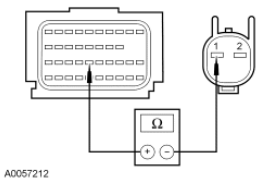
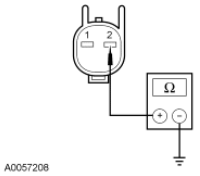
- wiring, terminals or connectors.
- a faulty passenger safety belt buckle switch.
- a faulty RCM.

PINPOINT TEST Q: LFC 52/DTC B2692 — PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FAULT

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
Q1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to Q2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to Q7 .

air curtain deployment. **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC B2692 retrieved during the on-demand self test?**	
Q2 CHECK CIRCUIT 8-JA55 (WH/BK) FOR A SHORT TO BATTERY BETWEEN THE PASSENGER SAFETY BELT BUCKLE AND RCM	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Seat Side Air Bag Module C337 or Passenger Seat Side Thorax Air Bag Module C3227. • Connect: Restraint System Diagnostic Tool 418-133 to Passenger Seat Side Air Bag Module C337 or Restraint System Diagnostic Tool 501-097 to Passenger Seat Side Thorax Air Bag Module C3227. • Disconnect: RCM C310b. • Disconnect: Passenger Safety Belt Buckle Switch C3066. • Ignition ON. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the voltage between passenger safety belt buckle switch C3066-1, circuit 8-JA55 (WH/BK), harness side and ground.  A0057209 • **Is the voltage less than 0.2 volt?**	**Yes** GO to Q3 . **No** REPAIR circuit 8-JA55 (WH/BK). GO to Q8 .
Q3 CHECK CIRCUIT 8-JA55 (WH/BK) FOR AN OPEN BETWEEN THE PASSENGER SAFETY BELT BUCKLE SWITCH AND RCM	

• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure the resistance between passenger safety belt buckle switch C3066-1, circuit 8-JA55 (WH/BK), harness side and RCM C310b-26, circuit 8-JA55 (WH/BK).  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to Q4 . **No** REPAIR circuit 8-JA55 (WH/BK) in the seat wiring harness. GO to Q8 .
Q4 CHECK CIRCUIT 31-JA55 (BK/RD) FOR AN OPEN	
• Measure the resistance between the passenger buckle switch C3066-2, circuit 31-JA55 (BK/RD), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to Q5 . **No** REPAIR circuit 31-JA55 (BK/RD). GO to Q8 .
Q5 CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH	
• Connect: RCM C310b. • Install a known good passenger safety belt buckle. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2692 retrieved during the on-demand self test?**	**Yes** GO to Q6 . **No** Fault corrected. GO to Q8 .
Q6 CONFIRM RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF.	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) . GO to Q8 . **No** CHECK for causes of the intermittent fault. ATTEMPT to

• Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Reinstall the original passenger safety belt buckle switch. Refer to Section 501-20A . • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2692 retrieved during the on-demand self test?**	recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to Q8 .
Q7 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC B2692 retrieved during the on-demand self test?**	**Yes** GO to Q2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to Q8 .
Q8 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step Q1. • **Were any continuous DTCs retrieved during Step Q1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test R: LFC15/DTC C1414 — Incorrect Vehicle ID

Normal Operation

Hard Wire Vehicle ID

The RCM monitors the electrical condition at C310a pin 20 and C310a pin 21 to detect the vehicle identification code. The RCM compares the pin state with a preprogrammed code. If the RCM detects an unexpected condition at either of these pins, it will store diagnostic trouble code (DTC) C1414 in memory and flash lamp fault code (LFC) 15 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

An incorrect vehicle identification code can be caused by:

- incorrect RCM for vehicle.
- wiring, terminals or connectors.

PINPOINT TEST R: DTC C1414 — INCORRECT VEHICLE ID

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
R1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs.	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to R2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to R5 .

• **Was DTC C1414 retrieved during the on-demand self test?**	
R2 CHECK VEHICLE IDENTIFICATION NO. 1	
NOTE: For this vehicle application, RCM C310a-20 should be grounded and C310a-21 should have no wire attached. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Disconnect: RCM C310b. • Measure the resistance between RCM C310a-20, circuit JA-310A (BK/RD), harness side and ground. • **Is the resistance less than 5 ohms?**	**Yes** GO to R3 . **No** REPAIR the circuit. GO to R6 .
R3 CHECK VEHICLE IDENTIFICATION NO. 2	
NOTE: For this vehicle application, RCM C310a-20 should be grounded and C310a-21 C310a-21 should have no wire attached. • Inspect RCM C310a harness side. Make sure there is no wire attached to pin cavity 21. • **Does cavity 21 contain a wire?**	**Yes** DETERMINE the cause of incorrect vehicle harness configuration. REPAIR as necessary. GO to R6 . **No** GO to R4 .
R4 CHECK THE RCM PART NUMBER	
• Check the part number on the RCM against the part number listed in the master parts catalog. • **Did the part number on the RCM match the part number listed in the master parts catalog?**	**Yes** INSTALL a new RCM with the same part number. Refer to Restraints Control Module (RCM) in this section.GO to R6 . **No** INSTALL a new RCM with the correct part number. REFER to Restraints Control Module (RCM) .GO to R6 .
R5 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: Retrieved/Record Continuous DTCs. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1414 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to R2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. REPAIR any intermittent concerns found. GO to R6 .
R6 CHECK FOR ADDITIONAL DTCs	

• Refer to the continuous DTCs recorded during Step R1. • **Were any additional DTCs retrieved during Step R1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test S: LFC 49/DTC C1947 — Seat Track Position Sensor Circuit Short To Ground

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects a short to ground, it will store diagnostic trouble code (DTC) C1947 in memory and flash lamp fault code (LFC) 49 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

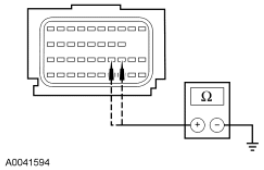
A driver seat track position sensor short to ground fault can be caused by:

- damaged wiring, terminals or connectors.
- a faulty driver seat track position sensor.
- a faulted RCM.

PINPOINT TEST S: LFC 49/DTC C1947 — SEAT TRACK POSITION SENSOR CIRCUIT SHORT TO GROUND

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
S1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to S2 . **No** This is an intermittent fault. The

⚠ **WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** ⚠ **WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC C1947 retrieved during the on-demand self test?**	fault condition is not present at this time. GO to S5 .
S2 CHECK CIRCUIT 7-JA53 (YE/RD) AND CIRCUIT 9-JA53 (BN/RD) FOR A SHORT TO GROUND BETWEEN THE RCM AND THE DRIVER SEAT	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Seat Track Position Sensor C3207. • Measure the resistance between RCM C310b-23, circuit 7-JA53 (YE/RD), harness side and ground; and between C310b-24, circuit 9-JA53 (BN/RD), harness side and ground.  A0041594 • **Are the resistances greater than 1,000,000 ohms?**	**Yes** GO to S3 . **No** REPAIR circuit 7-JA53 (YE/RD) or circuit 9-JA53 (BN/RD). GO to S6 .
S3 CHECK THE SEAT TRACK POSITION SENSOR	
• Connect: RCM C310b.	**Yes** GO to S4 .

• Install a known good seat track position sensor. Refer to Seat Position Sensor in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1947 retrieved during the on-demand self test?**	**No** Fault corrected. GO to S6 .
S4 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Reinstall the original seat track position sensor. Refer to Seat Position Sensor in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self-Test. • **Was DTC C1947 retrieved during the on-demand self test?**	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to S6 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to S6 .
S5 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1947 retrieved during the on-demand self test?**	**Yes** GO to S2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to S6 .
S6 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step S1. • **Were any continuous DTCs retrieved during Step S1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system.

	REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test T: LFC 49/DTC C1948 — Seat Track Position Sensor Circuit Resistance Out Of Range

NOTE: Due to the seat track position sensor being a Hall-effect type sensor, this pinpoint test will be diagnosing a current out of range fault instead of the current DTC definition for a resistance out of range fault.

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects a current out of range condition, it will store diagnostic trouble code (DTC) C1948 in memory and flash lamp fault code (LFC) 49 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

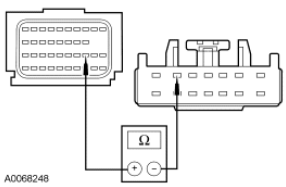
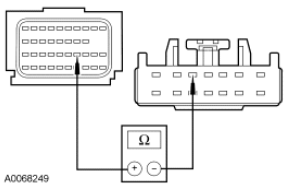
A seat track sensor circuit resistance out of range fault can be caused by:

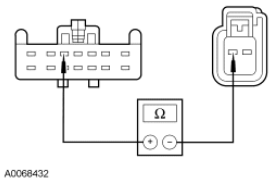
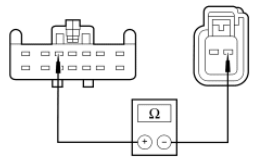
- damaged wiring, terminals or connectors.
- a faulty driver seat track position sensor.
- a faulted RCM.

PINPOINT TEST T: LFC 49/DTC C1948 — SEAT TRACK POSITION SENSOR CIRCUIT RESISTANCE OUT OF RANGE

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
T1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to T2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to T8 .

personal injury. **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC C1948 retrieved during the on-demand self test?**	
T2 CHECK CIRCUIT 7-JA53 (YE/RD) FOR AN OPEN	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Driver Seat C315. • Measure the resistance between RCM C310b-23, circuit 7-JA53 (YE/RD), harness side and driver seat C315-2, circuit 7-JA53 (YE/RD), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to T3 . **No** REPAIR circuit 7-JA53 (YE/RD). GO to T9 .
T3 CHECK CIRCUIT 9-JA53 (BN/RD) FOR AN OPEN	
• Measure the resistance between RCM C310b-24, circuit 9-JA53 (BN/RD), harness side and driver seat C315-3, circuit 9-JA53 (BN/RD), harness side.  • **Is the resistance less than 0.5 ohm?**	**Yes** GO to T4 . **No** REPAIR circuit 9-JA53 (BN/RD). GO to T9 .

T4 CHECK CIRCUIT 7-JA53 (YE/RD) FOR AN OPEN	
• Disconnect: Seat Track Position Sensor C3207. • Measure the resistance between seat track position sensor C3207-2, circuit 7-JA53 (YE/RD), harness side and driver seat C315-2, circuit 7-JA53 (YE/RD), harness side.  A0068432 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to T5 . **No** REPAIR circuit 7-JA53 (YE/RD). GO to T9 .
T5 CHECK CIRCUIT 9-JA53 (BN/RD) FOR AN OPEN	
• Measure the resistance between seat track position sensor C3207-3, circuit 9-JA53 (BN/RD), harness side and driver seat C315-1, circuit 9-JA53 (BN/RD), harness side.  A0068433 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to T6 . **No** REPAIR circuit 7-JA53 (YE/RD). GO to T9 .
T6 CHECK THE SEAT TRACK POSITION SENSOR	
• Connect: RCM C310b. • Install a known good seat track position sensor. Refer to Seat Position Sensor in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1948 retrieved during the on-demand self test?**	**Yes** GO to T7 . **No** Fault corrected. GO to T9 .
T7 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this	**Yes** INSTALL a new RCM. REFER to Restraints Control Module (RCM) in this section. GO to T9 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition

section. • Reinstall the original seat track position sensor. Refer to Seat Position Sensor in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1948 retrieved during the on-demand self test?**	key frequently. REPAIR any intermittent concerns found. GO to T9 .
T8 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1948 retrieved during the on-demand self test?**	**Yes** GO to T2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to T9 .
T9 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step T1. • **Were any continuous DTCs retrieved during Step T1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test U: LFC 49/DTC C1981 — Seat Track Position Sensor Circuit Fault

Normal Operation

The restraints control module (RCM) monitors the driver seat track position sensor circuits. If the RCM detects an open or short to battery, it will store diagnostic trouble code (DTC) C1981 in memory and flash lamp fault code (LFC) 49 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A driver seat track position sensor open circuit or short to battery fault can be caused by:

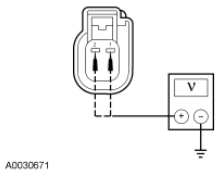
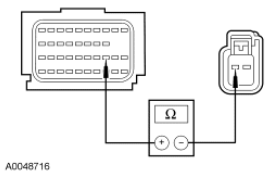
- damaged wiring, terminals or connectors.
- a faulty seat track position sensor.

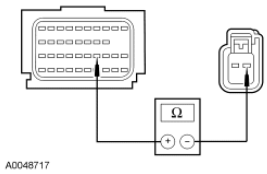
- a faulted RCM.

PINPOINT TEST U: LFC 49/DTC C1981 — SEAT TRACK POSITION SENSOR CIRCUIT FAULT

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
U1 CHECK FOR A HARD OR INTERMITTENT DTC	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.** **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • Enter the following diagnostic mode on the scan tool: Retrieve/Record Continuous DTCs. • **Was DTC C1981 retrieved during the on-demand self test?**	**Yes** This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to U2 . **No** This is an intermittent fault. The fault condition is not present at this time. GO to U7 .
U2 CHECK CIRCUIT 7-JA53 (YE/RD) AND CIRCUIT 9-JA53 (BN/RD) FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310b. • Disconnect: Driver Seat Position Sensor C3207. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure the voltage between driver seat position sensor C3207-2, circuit 7-JA53 (YE/RD), harness side and ground, and between C3207-1, circuit 9-JA53 (BN/RD), harness side and ground.  A0030671 • **Are the voltages less than 0.2 volt?**	**Yes** GO to U3 . **No** REPAIR circuit 7-JA53 (YE/RD) or circuit 9-JA53 (BN/RD). GO to U8 .
U3 CHECK CIRCUIT 7-JA53 (YE/RD) FOR AN OPEN	
• Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition OFF. • Measure the resistance between RCM C310b-23, circuit 7-JA53 (YE/RD), harness side and driver seat C3207-2, circuit 7-JA53 (YE/RD), harness side.  A0048716 • **Is the resistance less than 0.5 ohm?**	**Yes** GO to U4 . **No** REPAIR circuit 7-JA53 (YE/RD). GO to U8 .
U4 CHECK CIRCUIT 9-JA53 (BN/RD) FOR AN OPEN	
• Measure the resistance between RCM C310b-24, circuit 9-JA53 (BN/RD), harness side and driver seat C3207-1, circuit 9-JA53 (BN/RD), harness side.	**Yes** GO to U5 . **No** REPAIR circuit 9-JA53 (BN/RD). GO to U8 .

 • **Is the resistance less than 0.5 ohm?**	
U5 CHECK THE SEAT TRACK POSITION SENSOR	
• Connect: RCM C310b. • Install a known good seat track position sensor. Refer to Seat Position Sensor in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1981 retrieved during the on-demand self test?**	**Yes** GO to U6 . **No** Fault corrected. GO to U8 .
U6 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Install the original seat track position sensor. Refer to Seat Position Sensor in this section. • Repower the system. **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1981 retrieved during the on-demand self test?**	**Yes** INSTALL a new RCM. REFER to Driver Air Bag Module in this section. GO to U8 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to U8 .
U7 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Was DTC C1981 retrieved during the on-demand self test?**	**Yes** GO to U2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to U8 .
U8 CHECK FOR ADDITIONAL DTCs	
• Refer to the continuous DTCs recorded during Step U1. • **Were any continuous DTCs retrieved during Step U1?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM)

	Diagnostic Trouble Code (DTC) Table in this section for pinpoint test direction. **No** RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

Pinpoint Test V: No Communication With The Restraints Control Module (RCM)

Normal Operation

The diagnostic tool communicates with the restraints control module (RCM) monitors through the data link connector (DLC) C251-7.

Possible Causes

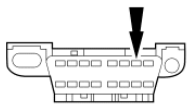
A no communication fault with the RCM can be caused by:

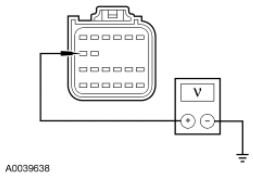
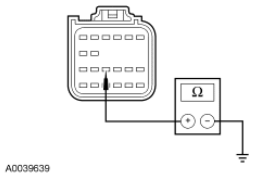
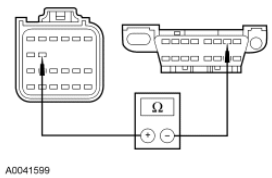
- damaged wiring, terminals or connectors.
- a faulty data link connector (DLC).
- a faulted RCM.

PINPOINT TEST V: NO COMMUNICATION WITH THE RESTRAINTS CONTROL MODULE (RCM)

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough Inspection and Verification before proceeding with the Pinpoint Test.

Test Step	Result / Action to Take
V1 CHECK THE RCM C310a-11 FOR DAMAGE	
⚠ WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove restraint system diagnostic tools could result in injury and possible violation of vehicle safety standards. **⚠ WARNING: Never probe the connectors on the air bag module. Doing**	**Yes** GO to V2 . **No** REPAIR RCM C310a or RCM C310a pin 11 as necessary. RETEST the communication to the RCM. RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to

so can result in air bag deployment, which can result in personal injury. **⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.** **⚠ WARNING: Never probe the electrical connector on a side air curtain module. Doing so can result in side air curtain deployment.** **NOTE:** After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.** **NOTE:** The SRS must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the system. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a. • Inspect the RCM C310a-11 , harness side and RCM C310a, pin 11, component side for damage. • **Are RCM C310a and RCM C310a pin 11 OK?**	Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.
V2 CHECK THE DLC C251-7 FOR DAMAGE	
• Inspect the DLC C251 and DLC C251-7 or damage.  A0030459 • **Are DLC C251 and DLC C251-7 OK?**	**Yes** GO to V3 . **No** REPAIR DLC C251 or DLC C251-7 as necessary. RETEST the communication to the RCM. RECONNECT the system. If previously directed to deactivate the system, REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. REPOWER the system. REFER to Supplemental Restraint System (SRS) Depowering and Repowering in this section. PROVE OUT the system. CLEAR all DTCs.

V3 CHECK THE IGNITION CIRCUIT 15-JA10A (GN/OG) FOR AN OPEN	
• Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Ignition ON. • Measure the voltage between RCM C310a-12, circuit 15-JA10A (GN/OG), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to V4 . **No** VERIFY central junction box (CJB) fuse 5 (10A) is OK. If OK, REPAIR circuit 15-JA10A (GN/OG). RETEST the communication to the RCM. REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.
V4 CHECK THE GROUND CIRCUIT 31-JA10 (BK/RD) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between RCM C310a-16, circuit 31-JA10 (BK/RD), harness side and a sheet metal ground near the RCM.  • **Is the resistance less than 5 ohms?**	**Yes** GO to V5 . **No** REPAIR circuit 31-JA10 (BK/RD). RETEST the communication to the RCM. REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.
V5 CHECK CIRCUIT 4-EE1 (GY/RD) AND 4-EE10 (GY/BK) FOR AN OPEN	
• Measure the resistance between RCM C310a-11, circuit 4-EE1 (GY/RD), harness side and the DLC C251-7, circuit 4-EE10 (GY/BK), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to V6 . **No** REPAIR circuit 4-EE1 (GY/RD) or circuit 4-EE10 (GY/BK). RETEST the communication to the RCM. REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.
V6 CONFIRM THE RCM FAULT	

NOTE: Make sure the safety belt pretensioner restraint system diagnostic tools, sensor electrical connectors and the RCM electrical connector are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded. • Connect: RCM C310a. • Enter the following diagnostic mode on the scan tool: On-Demand Self Test. • **Did the diagnostic tool communicate with the RCM?**	**Yes** Fault corrected. REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. **No** INSTALL a new RCM. RETEST the communication to the RCM. REACTIVATE the system. REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

Supplemental Restraint System (SRS) Depowering and Repowering

Depowering Procedure

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, **the SRS must be depowered.**

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF.

2. Turn the ignition switch to OFF.

3. Remove the RH kick panel cover and remove the restraints control module fuse 5 (10A) from the central junction box (CJB). For additional information, refer to the Wiring Diagram Manual.

4. Turn the ignition ON and visually monitor the air bag indicator for at least 30 seconds. The air bag indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. **⚠ WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

   The first row side impact sensors are located at or near the base of the B-pillars.

   The second row side impact sensors (if equipped) are located at or near the base of the C-pillars.

   To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to Section 414-00 .

Repowering Procedure

1. ⚠ **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

   Make sure all restraint system diagnostic tool(s) that may have been installed during the repair have been removed from the vehicle and all SRS components are connected.

2. Turn the ignition switch from OFF to ON.

3. Install the restraints control module fuse 5 (10A) to the CJB and install the RH kick panel cover.

4. ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**

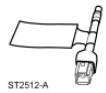
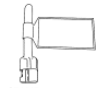
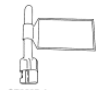
   Connect the battery ground cable.

5. Prove out the supplemental restraint system (SRS) as follows:
   Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an air bag supplemental restraint system (SRS) fault is present, the air bag indicator will:
   - fail to light.
   - remain lit continuously.
   - flash.

   The flashing might not occur until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the restraints control module (RCM) to complete the testing of the SRS. If the air bag indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator and any SRS fault discovered must be diagnosed and repaired.
   Clear all continuous DTCs from the restraints control module using a diagnostic tool.

Supplemental Restraint System (SRS) Deactivation and Reactivation

Special Tool(s)

ST2502-A	Diagnostic Tool, Restraint System (2 required) 418-F395 (014-R1079)
 ST2512-A	Diagnostic Tool, Restraint System (1 required) 418-F403
 ST2507-A	Diagnostic Tool, Restraint System (2 required) 418-133 (014-R1076)
 ST2507-A	Diagnostic Tool, Restraint System (4 required) 501-097

Deactivation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. Turn all vehicle accessories OFF.

2. Turn the ignition switch to OFF.

3. Remove the RH kick panel cover and remove the restraints control module fuse 5 (10A) from the central junction box (CJB). For additional information, refer to the Wiring Diagram Manual.

4. Turn the ignition ON and visually monitor the air bag indicator for at least 30 seconds. The air bag indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. ⚠ **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

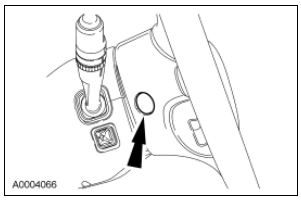
   The first row side impact sensors are located at or near the base of the B-pillars.

   The second row side impact sensors (if equipped) are located at or near the base of the C-pillars.

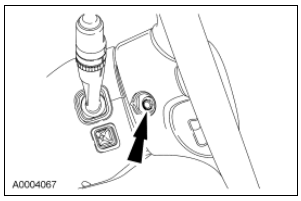
   To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

   Disconnect the battery ground cable (14301) and wait at least 1 minute. For additional information, refer to Section 414-01 .

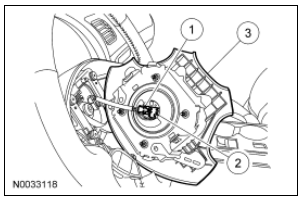
7. Remove the 2 steering wheel plugs (1 shown).



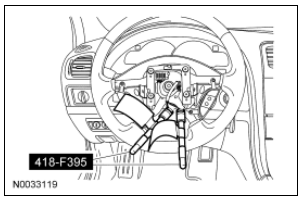
8. Remove the 2 driver air bag module bolts (1 shown).



9. Disconnect and remove the driver air bag module.
   1. Squeeze the tabs and disconnect the driver air bag module electrical connector.
   2. Squeeze the tabs and disconnect the driver air bag module electrical connector.
   3. Remove the driver air bag module.



10. Attach the restraint system diagnostic tools to the clockspring electrical connectors at the top of the steering column.

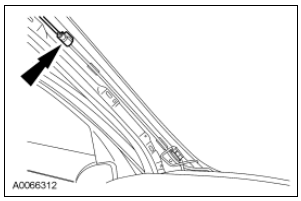


Vehicles with side air curtains

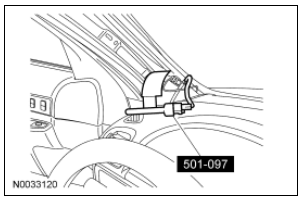
NOTE: If the headliner has the word "AIRBAG" embossed on it near each B-pillar, the vehicle is equipped with side air curtain modules.

11. Remove the A-pillar trim panel. For additional information, refer to Section 501-05 .

12. Disconnect the driver side air curtain module electrical connector.



13. Attach the restraint system diagnostic tool to the vehicle harness side of the driver side air curtain module electrical connector.



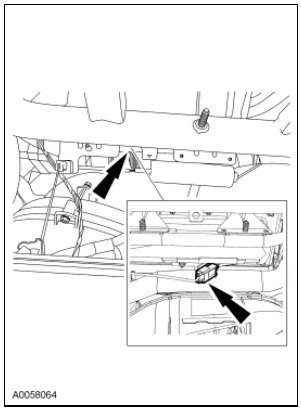
All vehicles

14. Remove the glove compartment. For additional information, refer to Section 501-05 .

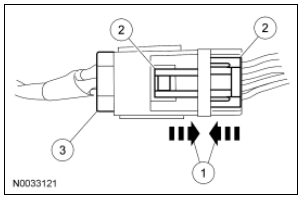
15. **NOTE:** The inset view of the illustration is looking up into the instrument panel from underneath.

    NOTE: The passenger air bag module electrical connector is located in front of the cross-car beam attached by a pin-type retainer to a bracket on the back of the passenger air bag module.

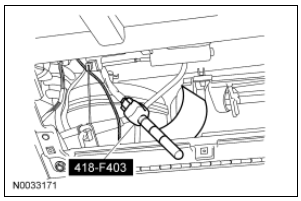
    Locate the passenger air bag module electrical connector.



16. Disconnect the passenger air bag module.
    1. Push the passenger air bag module electrical connector together.
    2. Push down, pivoting the electrical connector and release the electrical connector retainer.
    3. Pull out, disconnecting the vehicle harness end of the connector from the component end.



17. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag module electrical connector.

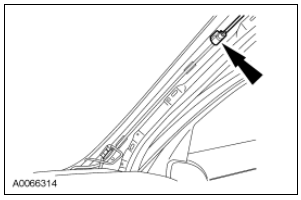


Vehicles with side air curtains

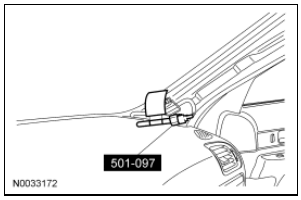
NOTE: If the headliner has the word "AIRBAG" embossed on it near each B-pillar, the vehicle is equipped with side air curtain modules.

18. Remove the A-pillar trim panel. For additional information, refer to Section 501-05 .

19. Disconnect the passenger side air curtain module electrical connector.

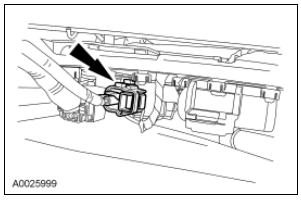


20. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger side air curtain module electrical connector.



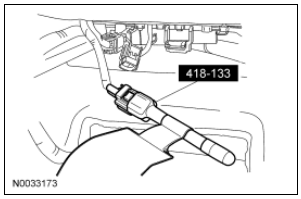
All vehicles

21. From under the passenger seat, release the tab and disconnect the passenger seat side air bag or passenger seat side thorax air bag electrical connector.



Vehicles without side air curtains

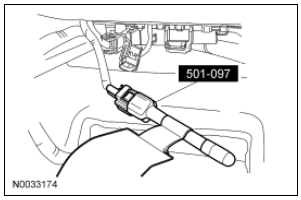
22. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger seat side air bag electrical connector.



Vehicles with side air curtains

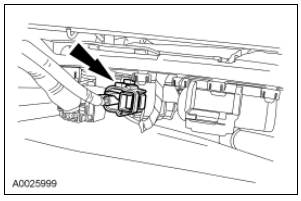
NOTE: If the headliner has the word "AIRBAG" embossed on it near each B-pillar, the vehicle is equipped with side air curtain modules.

23. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger seat side thorax air bag electrical connector.



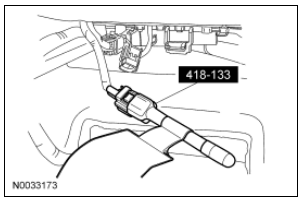
All vehicles

24. From under the driver seat, release the tab and disconnect the driver seat side air bag or driver seat side thorax air bag electrical connector.



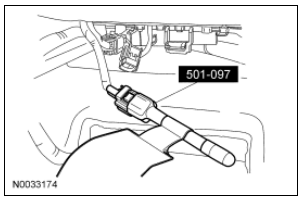
Vehicles without side air curtains

25. Attach the restraint system diagnostic tool to the vehicle harness side of the driver seat side air bag electrical connector.



Vehicles with side air curtains

26. Attach the restraint system diagnostic tool to the vehicle harness side of the driver seat side thorax air bag electrical connector.



All vehicles

27. Install the RCM fuse 5 to the CJB.

28. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Reactivation

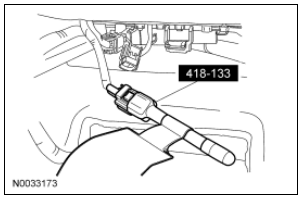
All vehicles

1. Remove the RCM fuse 5 from the CJB.

2. Disconnect the battery ground cable and wait at least 1 minute.

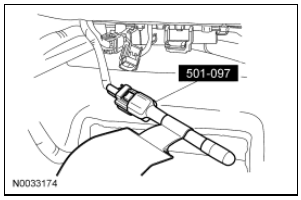
Vehicles without side air curtains

3. Remove the restraint system diagnostic tool from the vehicle harness side of the driver seat side air bag electrical connector.



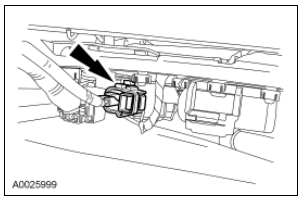
Vehicles with side air curtains

4. Remove the restraint system diagnostic tool from the vehicle harness side of the driver seat side thorax air bag electrical connector.



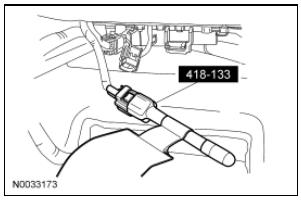
All vehicles

5. Connect the driver seat side air bag or driver seat side thorax air bag electrical connector.



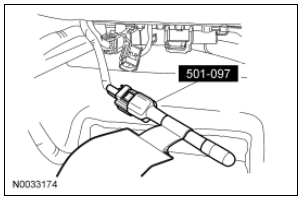
Vehicles without side air curtains

6. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger seat side air bag electrical connector.



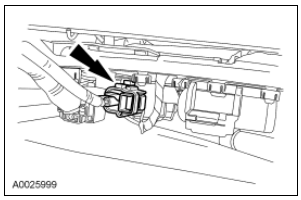
Vehicles with side air curtains

7. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger seat side thorax air bag electrical connector.



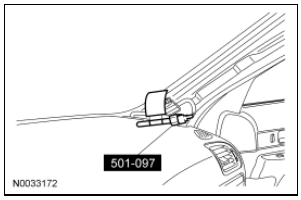
All vehicles

8. Connect the passenger seat side air bag or passenger seat side thorax air bag electrical connector.

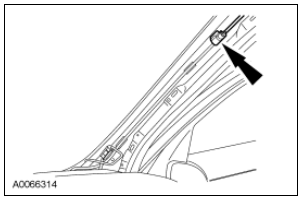


Vehicles with side air curtains

9. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger side air curtain module electrical connector.



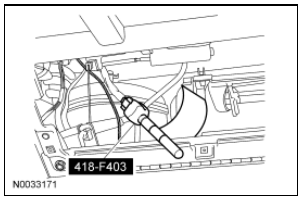
10. Connect the passenger side air curtain module electrical connector.



11. Install the A-pillar trim panel. For additional information, refer to Section 501-05 .

All vehicles

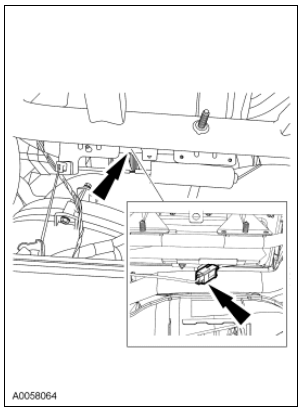
12. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.



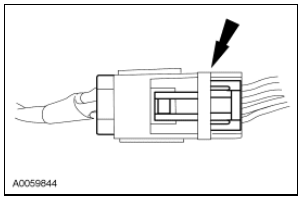
13. **NOTE:** The inset view of the illustration is looking up into the instrument panel from underneath.

    NOTE: The passenger air bag module electrical connector is located in front of the cross-car beam attached by a pin-type retainer to a bracket on the back of the passenger air bag module.

    Locate the passenger air bag module electrical connector.



14. Connect the passenger air bag module.

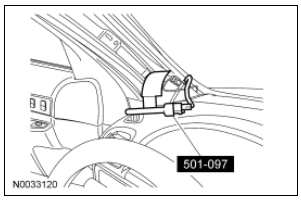


15. Install the glove compartment. For additional information, refer to Section 501-05 .

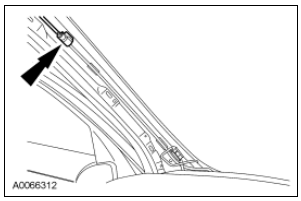
Vehicles with side air curtains

NOTE: If the headliner has the word "AIRBAG" embossed on it near each B-pillar, the vehicle is equipped with side air curtain modules.

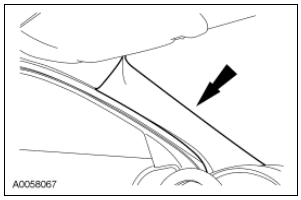
16. Remove the restraint system diagnostic tool from the vehicle harness side of the driver side air curtain module electrical connector.



17. Connect the driver side air curtain module electrical connector.

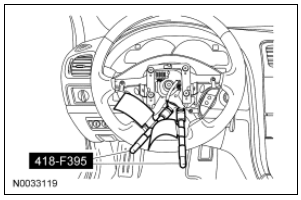


18. Install the A-pillar trim panel. For additional information, refer to Section 501-05 .



All vehicles

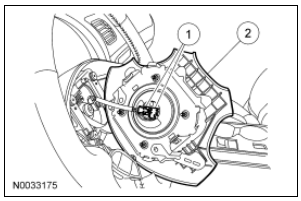
19. Remove the restraint system diagnostic tools from the clockspring electrical connectors at the top of the steering column.



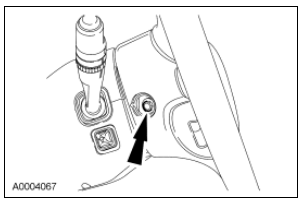
20. ***NOTICE:*** **The clockspring electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module.**

Connect and position the driver air bag module.

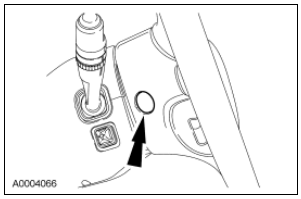
1. Connect the driver air bag module electrical connectors.
2. Position the driver air bag module to the steering wheel.



21. Install the 2 driver air bag module bolts (1 shown).
    - Tighten to 12 Nm (9 lb-ft).



22. Install the 2 steering wheel plugs (1 shown).



23. Turn the ignition switch from OFF to ON.

24. Install the restraints control module fuse 5 (10A) to the CJB and install the RH kick panel cover.

25. ⚠ **WARNING: Be sure that nobody is in the vehicle and that there is nothing blocking or set in front of any air bag module when the battery ground cable is connected.**

    Connect the battery ground cable.

26. Prove out the supplemental restraint system (SRS) as follows:
    Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an air bag supplemental restraint system (SRS) fault is present, the air bag indicator will:
    - fail to light.
    - remain lit continuously.
    - flash.

    The flashing might not occur until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the restraints control module (RCM) to complete the testing of the SRS. If the air bag indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator and any SRS fault discovered must be diagnosed and repaired.
    Clear all continuous DTCs from the restraints control module using a diagnostic tool.

Inspection and Repair After a Supplemental Restraint System (SRS) Deployment

⚠ WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death in a crash and possibly violate vehicle safety standards.

NOTE: After diagnosing or repairing a Supplemental Restraint System (SRS), the restraint system diagnostic tools (if required) must be removed before operating the vehicle over the road.

NOTE: Deployable devices (such as air bag modules, pretensioners) may deploy alone or in various combinations depending on the impact event.

NOTE: Always refer to the appropriate workshop manual procedures prior to carrying out vehicle repairs affecting the SRS and safety belt system.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. **NOTE:** Refer to the correct removal and installation procedure for all SRS components being installed.

   When any deployable device or combination of devices have deployed and/or the Restraints Control Module (RCM) has DTC B1231/B1193:00 (Event Threshold Exceeded) in memory, the repair of the vehicle SRS is to include the removal of all deployed devices and the installation of new deployable devices, the removal and installation of new impact sensors and the removal and installation of a new RCM . DTCs must be cleared from all required modules after repairs are carried out.

Vehicles with Occupant Classification Sensor (OCS) system

2. **NOTE:** After installation of new Occupant Classification Sensor (OCS) components, carry out the Occupant Classification Sensor (OCS) System Reset procedure as instructed in the workshop manual. Refer to the appropriate workshop manual for OCS system removal and installation procedure.

   When a vehicle has been involved in a collision and the Occupant Classification System Module (OCSM) has DTC B1231/B1193:00 stored in memory, the repair of the OCS system is to include the following procedures for the specified system:

   - For rail-type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install new OCS system rails. Do not install a new OCSM unless DTC B1231 cannot be cleared.
   - For weight sensor bolt-type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install a new seat track with OCS system weight sensor bolts. DTC must be cleared from the OCSM before carrying out Occupant Classification Sensor (OCS) System Reset. Do not install a new OCSM unless DTC B1231/B1193:00 cannot be cleared.
   - For bladder-type OCS system, inspect for damage and repair as necessary. If installation of an OCS system component is required, an OCS system service kit must be installed.

All vehicles

3. When any damage to the impact sensor mounting points or mounting hardware has occurred, repair or install new mounting points and mounting hardware as needed.

4. When the driver air bag module has deployed, a new clockspring must be installed.

5. New driver and/or front passenger safety belt systems (including retractors, buckles and height adjusters) must be installed if the vehicle is involved in a collision that results in deployment of the driver and/or front passenger safety belt pretensioners. For additional information, refer to Section 501-20A .

6. Inspect the entire vehicle for damage, including the following components:
    - Steering column (deployable column if equipped)
    - Instrument panel knee bolsters and mounting points
    - Instrument panel braces and brackets
    - Instrument panel and mounting points
    - Seats and seat mounting points
    - Safety belts, safety belt buckles and safety belt retractors. For additional information, refer to Section 501-20A
    - SRS wiring, wiring harnesses and connectors

7. After carrying out the review and inspection of the entire vehicle for damage, repair or install new components as needed.

Pyrotechnic Device Disposal

Disposal of Deployable Devices and Pyrotechnic Devices That are Undeployed/Inoperative

NOTE: All inoperative air bag modules and safety belt pretensioners have been placed on the Mandatory Return List. All discolored or damaged air bag modules must be treated the same as any inoperative live air bag being returned.

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the undeployed/inoperative device. For additional information, refer to the appropriate procedure in this section or Section 501-20A .

3. **NOTE:** When installing a new air bag module, a prepaid return postcard is provided with the replacement air bag module. The serial number for the new part and the Vehicle Identification Number (VIN) must be recorded and sent to Ford Motor Company.

   If installing a new air bag module, record the necessary information and return the inoperative air bag module to Ford Motor Company.

Disposal of Deployable Devices and Pyrotechnic Devices That Are Deployed

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the deployed device. For additional information, refer to the appropriate procedure in this section or Section 501-20A .

3. **NOTE:** If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to the Description and Operation portion of this section.

   Dispose of the deployed device in the same manner as any other part to be scrapped.

Disposal of Deployable Devices and Pyrotechnic Devices That Require Manual Deployment

1. Safety and environmental concerns require consideration and treatment of restraints system deployable and pyrotechnic devices when disposing of vehicles, deployable devices or pyrotechnic devices. Deploying deployable and pyrotechnic devices before scrapping a vehicle or the device eliminates the potential for hazardous exposures or reactions during processing. If special handling procedures are followed, deployable and pyrotechnic devices can be deployed safely and recycled with the vehicle, shipped separately to a recycling facility or disposed of safely.

   NOTE: To determine the deployable devices a vehicle is equipped with, refer to the Description and Operation portion of this section.

A vehicle equipped with any of the following deployable devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.

- Driver air bag module
- Passenger air bag module
- Seat side air bag modules
- Safety Canopy® modules
- Side air curtain modules

2. **NOTE:** To determine the pyrotechnic devices a vehicle is equipped with, refer to the Description and Operation portion of this section.

   A vehicle equipped with any of the following pyrotechnic devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.

   - Safety belt buckle pretensioners
   - Safety belt retractor pretensioners
   - Adaptive load-limiting retractors
   - Deployable steering column

3. **NOTE:** To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to the Description and Operation portion of this section.

   If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. For additional information, refer to Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules — Remote Deployment in this procedure.

Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules — Remote Deployment

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Always carry or place a live Safety Canopy®, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: For air bag modules with multiple loops, all the loops on the air bag module must be deployed.

NOTE: Some driver and passenger front air bags have 2 deployment stages. After a collision it is possible that Stage 1 has deployed and Stage 2 has not.

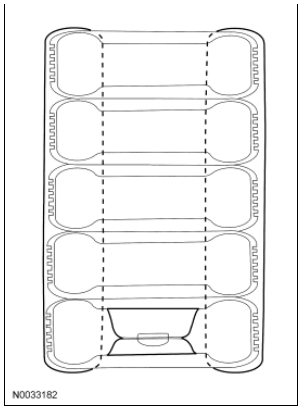
If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure.

NOTE: A typical air bag disposal is shown that is similar for all vehicles.

All driver, passenger and seat side air bag modules

1. Make a container to house the air bag module for deployment.
   - **NOTE:** The tires must be of sufficient size to accommodate the air bag module.

     Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
   - With the tire and wheel assembly on the bottom, stack the tires.
   - Securely tie all of the tires together.



2. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Remove the air bag module. For additional information, refer to the appropriate procedure in this section.

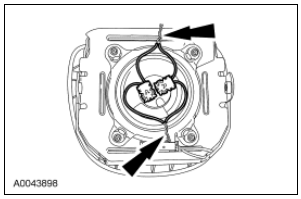
4. **NOTE:** If the air bag module does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the air bag module.

   Cut each of the air bag module wires near the electrical connector that connects to the vehicle wire harness.

5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

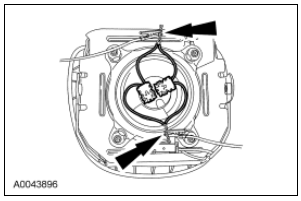
6. **NOTE:** Typical driver air bag module with 2 loops shown, other air bag modules with multiple loops similar.

   For air bag modules with multiple loops, twist together a wire from each loop then repeat for the remaining wires from each loop.



7. Make a jumper harness to deploy the air bag module.
    - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
    - At one end of the jumper harness, connect the wires together.

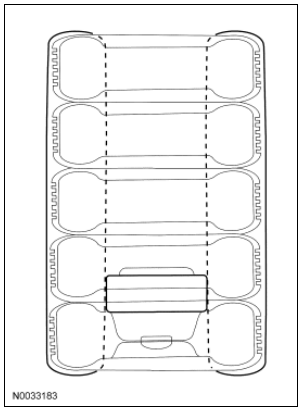
8. Using the end of the jumper harness where the wires are not connected together, attach each wire of the jumper harness to each wire of the air bag module or to the twisted-together wires if multiple loops. Use tape or other insulating material to make sure that the leads do not make contact with each other.



Driver air bag modules

9. **NOTE:** Make sure to maintain the connections to the air bag module.

    With the stack of tires upright and the wheel on the bottom, carefully place the driver air bag module, with the trim cover facing up, on the wheel.

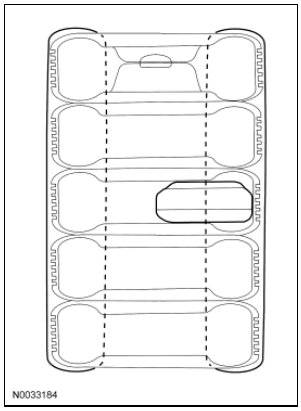


Passenger and seat side air bag modules

10. **NOTE:** Make sure to maintain the connections to the air bag module.

    Tip the stack of tires on its side and place the air bag module inside the center tire, making sure that there are 2 tires beneath the tire containing the air bag module and 2 tires (including the tire and wheel assembly) above the tire containing the air bag module.

11. Place the tire stack upright, with the wheel on top.



All driver, passenger and seat side air bag modules

12. Remain at least 9.14 m (30 ft) away from the air bag module.

13. From the end of the jumper harness that is not connected to the air bag module, disconnect the 2 wires of the jumper harness from each other.

14. Deploy the air bag module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

15. To allow for cooling, wait at least 10 minutes before approaching the deployed air bag module.

16. Dispose of the deployed air bag module in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Adaptive Load Limiting Safety Belt Retractors — Remote Deployment

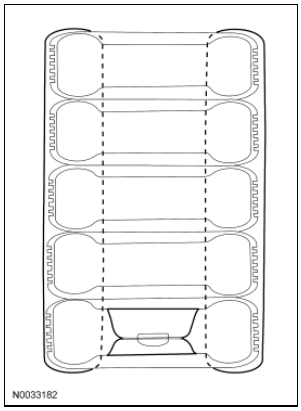
⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners or adaptive load limiting retractors or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors which increases the risk of serious personal injury or death.

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: A typical safety belt buckle and retractor disposal is shown that is similar for all vehicles.

1. Make a container to house the safety belt buckle or retractor for deployment.
    - **NOTE:** The tires must be of sufficient size to accommodate the safety belt buckle or retractor.

      Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
    - With the tire and wheel assembly on the bottom, stack the tires.
    - Securely tie all of the tires together.



2. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Remove the safety belt buckle or retractor. For additional information, refer to the appropriate procedure in Section 501-20A .
    - When deploying a safety belt buckle pretensioner, install a nut and bolt of sufficient length and of the same diameter as was used to retain it to the seat.

4. **NOTE:** If the safety belt buckle or retractor does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the safety belt buckle or retractor.

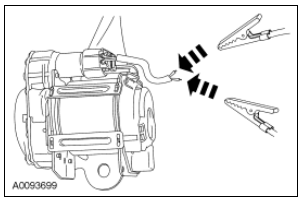
   Cut each of the safety belt buckle or retractor wires near the electrical connector that connects to the vehicle wire harness.

5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

6. Make a jumper harness to deploy the safety belt buckle or retractor.
    - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
    - At one end of the jumper harness, connect the wires together.

7. **NOTE:** Typical safety belt retractor pretensioner shown, other safety belt buckle pretensioners and load-limiting retractors similar.

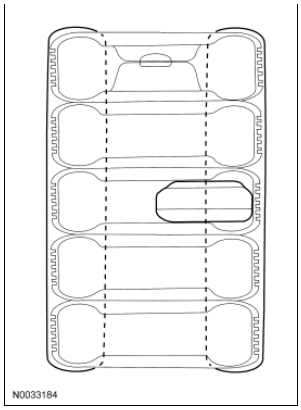
   Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.



8. **NOTE:** Make sure to maintain the connections to the safety belt buckle or retractor.

   Tip the stack of tires on its side and place the safety belt buckle or retractor inside the center tire, making sure that there are 2 tires beneath the tire containing the safety belt buckle or retractor and 2 tires (including the tire and wheel assembly) above the tire containing the safety belt buckle or retractor.

9. Place the tire stack upright, with the wheel on top.



10. Remain at least 9.14 m (30 ft) away from the safety belt buckle or retractor.

11. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.

12. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

13. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.

14. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Load Limiting Safety Belt Retractors — In-Vehicle Deployment

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners or adaptive load limiting retractors or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors which increases the risk of serious personal injury or death.

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: A typical safety belt buckle and retractor disposal is shown that is similar for all vehicles.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Access the safety belt buckle or retractor electrical connectors. For additional information, refer to Section 501-20A .

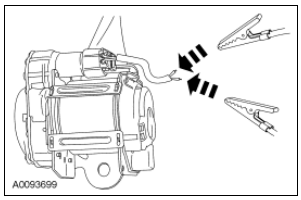
3. Cut each of the safety belt buckle or retractor wires, leaving at least 101.6 mm (4 in) to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

5. Make a jumper harness to deploy the safety belt buckle or retractor.
    - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
    - At one end of the jumper harness, connect the wires together.

6. **NOTE:** Typical safety belt retractor pretensioner shown, other safety belt buckle pretensioners and load-limiting retractors are similar.

   Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.



7. Remain at least 9.14 m (30 ft) away from the safety belt buckle or retractor.

8. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.

9. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.

11. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Canopy® Modules and Side Air Curtain Modules — In-Vehicle Deployment

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: The Safety Canopy® module deployment for a scrapped vehicle will occur in its installed position in the vehicle.

NOTE: A typical Safety Canopy® module disposal is shown that is similar for all vehicles.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

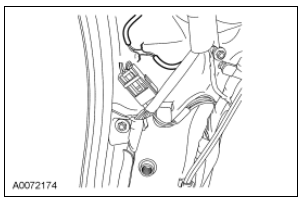
2. Access the Safety Canopy®/side air curtain module electrical connectors. For additional information, refer to the appropriate procedure in this section.

3. Cut each of the Safety Canopy®/side air curtain module wires leaving at least 101.6 mm (4 in) to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

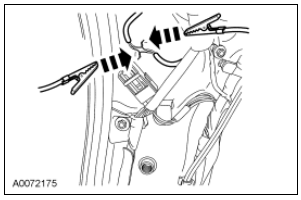
5. **NOTE:** Typical Safety Canopy®/side air curtain module with 2 loops shown, other Safety Canopy®/side air curtain modules with 2 loops are similar.

   For Safety Canopy®/side air curtain modules with multiple loops, twist together a wire from each loop then repeat for the remaining wires from each loop.



6. Make a jumper harness to deploy the Safety Canopy®/side air curtain module.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

7. Using the end of the jumper harness where the wires are not connected together, attach each wire of the jumper harness to each wire of the Safety Canopy®/side air curtain module or to the twisted-together wires if multiple loops. Use tape or other insulating material to make sure that the leads do not make contact with each other.



8. From the end of the jumper harness that is not connected to the Safety Canopy®/side air curtain module, disconnect the 2 wires of the jumper harness from each other.

9. Deploy the Safety Canopy®/side air curtain module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed Safety Canopy®/side air curtain module.

11. Dispose of the deployed Safety Canopy®/side air curtain module in the same manner as any other part to be scrapped.

Deployable Steering Column — In-Vehicle Deployment

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. **NOTE:** It may be necessary to lower or remove the deployable steering column from the instrument panel to access the deployable steering column electrical connector.

   Access the deployable steering column electrical connector.

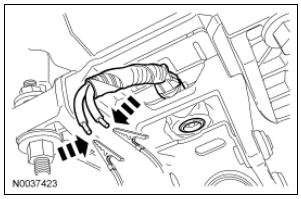
3. **NOTE:** If the deployable steering column does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the deployable steering column.

   Cut each of the deployable steering column wires, leaving at least 101.6 mm (4 in) to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

5. Make a jumper harness to deploy the deployable steering column.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

6. Using the end of the jumper harness where the wires are not connected together, attach each wire of the jumper harness to each wire of the deployable steering column. Use tape or other insulating material to make sure that the leads do not make contact with each other.



7. Remain at least 9.14 m (30 ft) away from the deployable steering column.

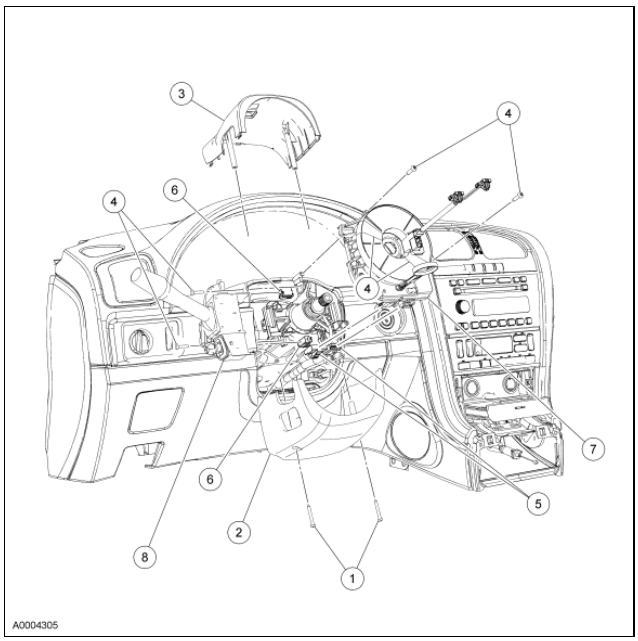
8. From the end of the jumper harness that is not connected to the deployable steering column, disconnect the 2 wires of the jumper harness from each other.

9. Deploy the deployable steering column by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed steering column.

11. Dispose of the deployed steering column in the same manner as any other part to be scrapped.

Clockspring



Item	Part Number	Description
1	W504246-S	Lower steering column shroud screws
2	3530	Lower steering column shroud
3	3530	Upper steering column shroud
4	W390345-S	Clockspring and multifunction switch screws (4 required)
5	—	Clockspring electrical connectors (part of 14401)
6	—	Multifunction switch electrical connector (part of 14401)
7	14A664	Clockspring
8	13K359	Multifunction switch

Removal

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: Air bag modules with discolored or damaged trim covers must be replaced, not repainted.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

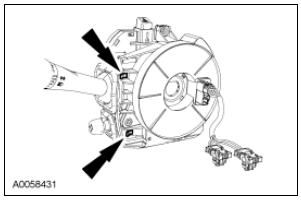
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Make sure the road wheels are in the straight-ahead position.
2. Tilt the steering column all the way down and extend it all the way out.
3. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
4. Remove the driver air bag module. For additional information, refer to Driver Air Bag Module in this section.
5. Remove the steering wheel. For additional information, refer to Section 211-04 .
6. Remove the screws and the instrument panel lower steering column cover.
7. Remove the instrument panel upper steering column cover.
8. **NOTE:** If the clockspring is to be reinstalled, do not allow the clockspring to turn from its removal position.

   Apply 2 strips of masking tape across the clockspring to prevent accidental rotation when the clockspring is removed.
9. **NOTE:** Remove the clockspring and multifunction switch as an assembly.

   Disconnect the 2 clockspring lower electrical connectors, the multifunction switch electrical connector and remove the clockspring and multifunction switch assembly.
10. Remove the 2 multifunction switch screws.
11. Remove the 2 clockspring screws and the clockspring assembly.
12. Release the tabs and slide the multifunction switch out of the clockspring.



Installation

1. ⚠ **WARNING: Incorrect centralization may result in premature component failure. If in doubt when centralizing the clockspring, repeat the centralizing procedure. Failure to follow this instruction may result in personal injury.**

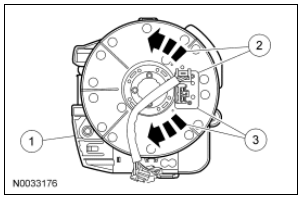
   NOTICE: **Make sure the road wheels are in the straight-ahead position.**

   NOTE: A new clockspring is supplied in a centralized position and held there with a key.

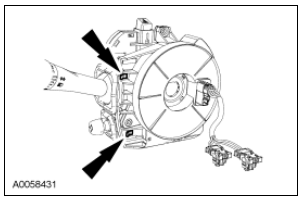
   If the clockspring has rotated out of center, follow these steps to center the clockspring.

   1. Hold the clockspring outer housing stationary.
   2. ***NOTICE:*** **Overturning will destroy the clockspring. The internal ribbon wire acts as the stop and can be broken from its internal connection.**

      While turning the rotor counterclockwise, carefully feel for the ribbon wire to run out of length and feel for a slight resistance. Stop turning at this point.
   3. Turn the clockspring clockwise approximately 2-1/2 turns. This is the center point of the clockspring.
   - Do not allow the rotor to turn from this position.

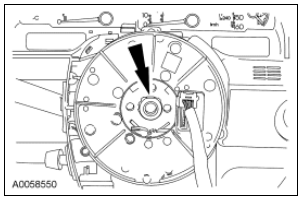


2. Align the multifunction switch to the clockspring and slide the 2 together.
   - Make sure the tabs are interlocked.



3. **NOTE:** Slight turning of the clockspring rotor is allowable for alignment purposes to the steering column.

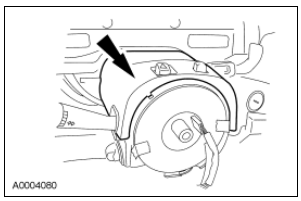
   With the flat of the clockspring aligned to the flat of the steering column, slide the clockspring onto the steering column.



4. Connect the 2 clockspring lower electrical connectors and the multifunction switch electrical connector.

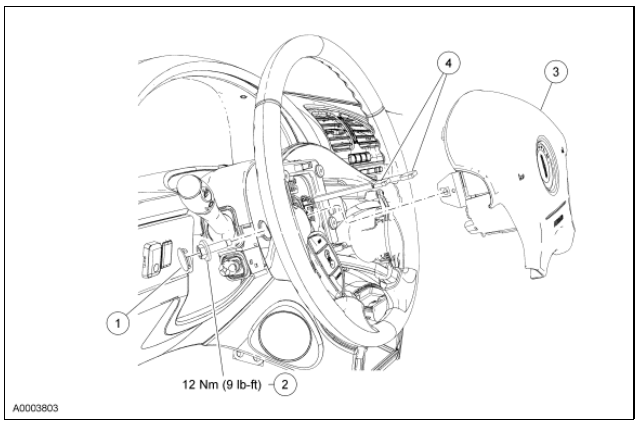
5. Install the 2 multifunction switch screws.

6. Install the 2 clockspring screws.
7. For vehicles receiving a new clockspring, remove the retaining pin.
8. For vehicles reusing the clockspring that was removed, remove the tape.
9. Install the instrument panel upper steering column cover.



10. Install the instrument panel lower steering column cover and screws.
11. Install the steering wheel. For additional information, refer to Section 211-04 .
12. Install the driver air bag module. For additional information, refer to Driver Air Bag Module in this section.
13. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Driver Air Bag Module



Item	Part Number	Description
1	3L518	Steering wheel back cover plugs (2 required)
2	W705342-S	Driver air bag module (2 required)
3	54043B13	Driver air bag module
4	—	Driver air bag module electrical connectors (part of 14A664)

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: Air bag modules with discolored or damaged trim covers must be replaced, not repainted.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

2. Remove the 2 steering wheel back cover plugs

3. Remove the 2 driver air bag module bolts.
   - To install, tighten to 12 Nm (9 lb-ft).

4. Remove the driver air bag module from the steering wheel.

5. **NOTE:** Label the driver air bag module squib number on the driver air bag module electrical connectors before disconnecting.

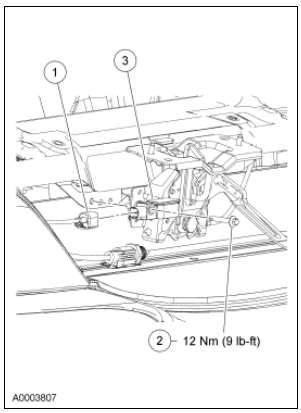
   Disconnect the driver air bag module electrical connectors at the clockspring and remove the air bag module.

6. ***NOTICE:*** **The clockspring electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module.**

   To install, reverse the removal procedure

7. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Front Impact Severity Sensor



Item	Part Number	Description
1	—	Front impact severity sensor electrical connector (part of 14290)
2	W707305-S	Front impact severity sensor bolt
3	14B006	Front impact severity sensor

Removal

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and correctly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
2. Disconnect the front impact sensor electrical connector.
3. Remove the front impact severity sensor bolt.
4. Remove the front impact severity sensor.

Installation

1. **NOTE:** Make sure the mounting bracket and front impact severity sensor mating surfaces are clean and free or foreign material.

   NOTE: Align the locator tabs of the front impact severity sensor to the openings in the mounting bracket sheet metal

   Install the front impact severity sensor.

2. ⚠ **WARNING: The tightening torque of the air bag front impact severity sensor retaining bolt is critical for correct system operation.**

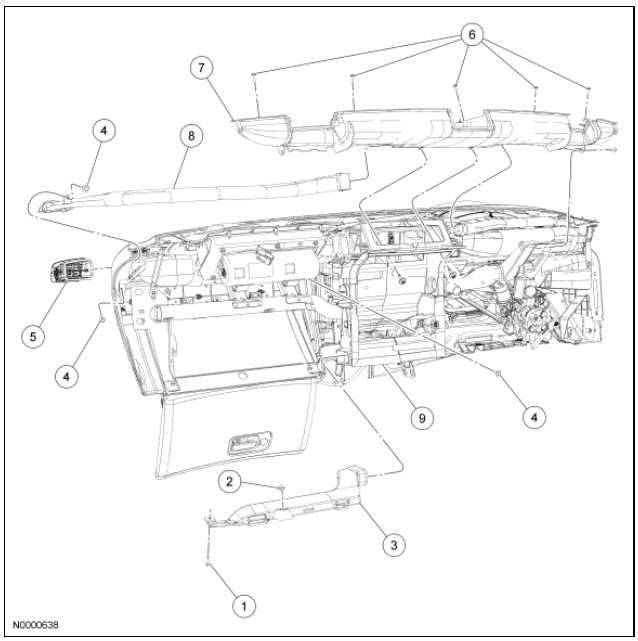
   Install the front impact severity sensor bolt.

   - Tighten to 12 Nm (9 lb-ft).

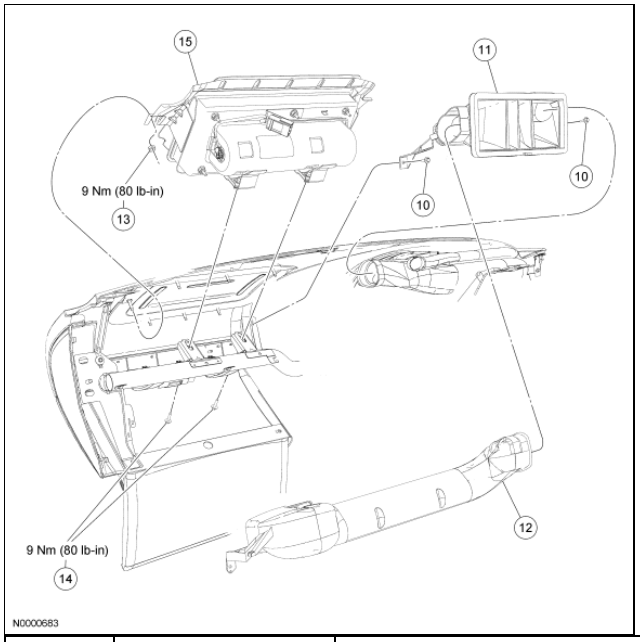
3. Connect the front impact severity sensor electrical connector.

4. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Passenger Air Bag Module



Item	Part Number	Description
1	W705314-S	Heater duct screw
2	—	Courtesy light socket
3	—	Floor heater duct
4	W704874-S	A/C duct screws (3 required)
5	19893	A/C register
6	W705314-S	Defrost nozzle screws (8 required)
7	18490	Defrost nozzle
8	19E630	Demister duct
9	19C698	A/C plenum chamber



Item	Part Number	Description
10	—	A/C junction duct screws (2 required)
11	19B680B	A/C junction duct assembly
12	19B680	A/C register duct
13	—	Passenger air bag module nuts (8 required)
14	—	Passenger air bag module bolts (2 required)
15	54044A74	Passenger air bag module

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Carry a live air bag module with the air bag and deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Do not set a live air bag module down with the deployment door face down. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: Air bag modules with discolored or damaged deployment doors must be replaced, not repainted.

⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

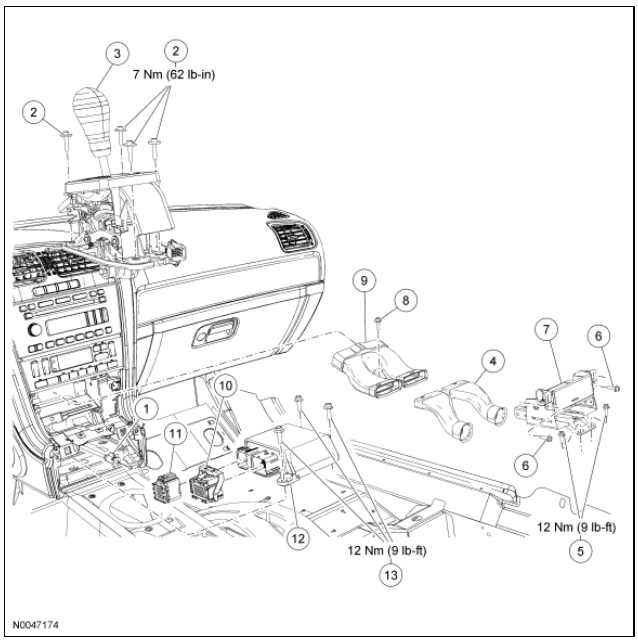
1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
2. Remove the instrument panel. For additional information, refer to Section 501-12 .
3. Position the instrument panel face down on the bench. Cover the work area with something clean and nonabrasive to protect the instrument panel.
4. Remove the RH floor duct screw.
5. Remove the RH courtesy lamp socket.
6. Remove the RH floor duct.
7. Remove the RH A/C duct screw near the center of the instrument panel.
8. Remove the 2 screws from the passenger side A/C and demister duct.
9. Remove the passenger side A/C register.
10. Remove the insulator tape (if equipped) and the 8 defroster duct screws.
11. Remove the defroster duct.
12. Remove the demister duct.
13. Remove the plenum chamber. For additional information, refer to Section 412-01 .
14. Remove the 2 A/C center junction duct screws.
15. Remove the center A/C junction duct assembly.
16. Remove the A/C register duct.
17. Remove the 8 passenger air bag module nuts.
    - To install, tighten to 9 Nm (80 lb-in).
18. Remove the 2 passenger air bag module bolts.
    - To install, tighten to 9 Nm (80 lb-in).
19. Disconnect the passenger air bag electrical connector.
20. Remove the passenger air bag module through the back of the instrument panel.
21. **NOTE:** If installing a new passenger air bag module, install new retaining nuts and bolts.

To install, reverse the removal procedure.

22. Install the instrument panel. For additional information, refer to Section 501-12 .

23. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Restraints Control Module (RCM)



Item	Part Number	Description
1	3F719	Shifter interlock cable
2	W705638-S	Shifter assembly bolts (4 required)
3	7210	Shifter assembly
4	19E714	Lower A/C duct
5	W707722-S	Ashtray housing bolts (2 required)
6	—	Ashtray housing screws (2 required)
7	—	Ashtray housing
8	—	Upper A/C duct bolt
9	19E714	Upper A/C duct
10	—	Large electrical connector (part of 14A005)
11	—	Small electrical connector (part of 14A005)
12	14B321	Restraints control module (RCM)
13	W707935- S437M	RCM bolts (3 required)

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: The restraints control module (RCM) orientation is critical for correct air bag supplemental restraint system (SRS) operation. If a vehicle equipped with an SRS system has been involved in a collision in which the center tunnel area has been damaged, inspect the mounting and bracket for deformation. If damaged, the RCM must be replaced whether or not the air bags have deployed. In addition, make sure the area of the RCM mounting is restored to its original condition.

⚠ WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and correctly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTICE: **Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage can result.**

NOTE: When installing a new restraints control module (RCM), always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

2. Remove the floor console. For additional information, refer to Section 501-12 .

3. Disconnect the shifter interlock cable from the shifter.

4. **NOTE:** Do not remove the shifter from the vehicle.

   Remove the shifter assembly bolts and position the shifter aside.

   - To install, tighten to 7 Nm (62 lb-in).

5. Remove the lower A/C duct.

6. Remove the 2 ash tray housing lower bolts.
   - To install, tighten to 12 Nm (9 lb-ft).

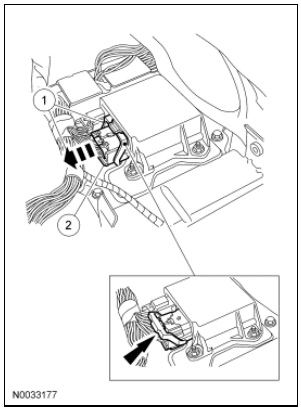
7. Remove the 2 ash tray housing upper screws and remove the housing assembly.

8. Remove the upper A/C duct bolt and remove the duct.

9. **NOTE:** The instrument panel has been removed for clarity.

   Disengage the large RCM electrical connector position assurance lever.

   1. Pinch the thumb tab and pivot the connector position assurance lever all the way back until it stops.
   2. Pull out and disconnect the RCM electrical connector.



10. Disconnect the large RCM connector.

11. Disconnect the small RCM electrical connector

12. Remove the RCM bolts and remove the RCM.
    - To install, tighten to 12 Nm (9 lb-ft).

13. ⚠ **WARNING: The tightening torque of the air bag restraints control module (RCM) retaining bolts is critical for correct system operation.**

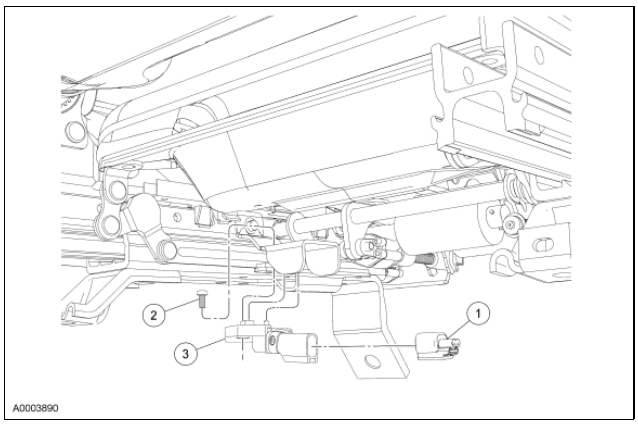
    NOTICE: **Putting the large RCM electrical connector into the RCM on an angle can cause bad electrical connections and damage components.**

    NOTICE: **Do not push the large RCM connector on to where the lever pivots and seats itself. Light pressure is needed to get the connector into position on the RCM before using the lever to fully seat the connector.**

    To install, reverse the removal procedure.

14. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Seat Position Sensor



Item	Part Number	Description
1	—	Seat position sensor electrical connector (part of 14B719)
2	—	Seat position sensor screw
3	14B416	Seat position sensor

Removal and Installation

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Raise the seat cushion to the full up position and position the seat to access the seat position sensor.

2. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. **NOTE:** Make note of the wiring harness routing for installation purposes.

NOTE: The seat track position sensor is mounted at the LH rear of the seat track.

Disconnect the seat position sensor electrical connector.

4. Remove the screw and seat position sensor.
5. **NOTE:** Align the seat position sensor locator tabs to the openings in the bracket.

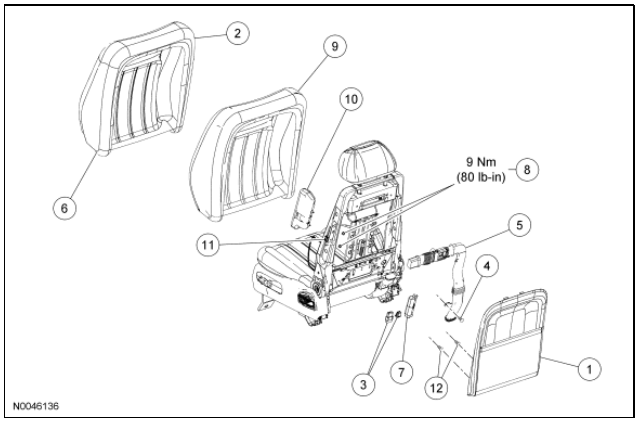
   NOTE: Route the wire harness as noted during removal.

   To install, reverse the removal procedure.

6. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Side Air Bag Module

Removal



Item	Part Number	Description
1	60762	Seat back trim panel
2	64416	Seat back trim cover
3	14C693	Connectors (2 required)
4	807452	Climate control duct pin-type retainer (if equipped)
5	18D512	Climate control duct (if equipped)
6	64416	Seat back trim cover
7	009036	Side air bag module nut cover
8	N620480-S	Side air bag module nuts (2 required)
9	64810	Seat back pad
10	11791	Side air bag module
11	14K155	Side air bag module connector
12	W709782-S	Pin-type retainers (2 required)

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Carry a live side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Do not set a live side air bag module down on the cover tear seam. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

⚠ WARNING: Side air bag modules with damaged covers must be replaced.

⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: If a side air bag deployment took place a new seat back pad, trim cover, and side air bag module must be installed. Install a new seat back frame if necessary.

NOTE: When installing a new side air bag after deployment, refer to Section 501-10 for additional information concerning the installation of a new side air bag.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

NOTE: Driver seat shown, passenger seat similar.

NOTE: Seat side air bag module shown, seat side thorax air bag module similar. For additional information, refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

NOTE: Seat with climate control and power lumbar shown, all others similar.

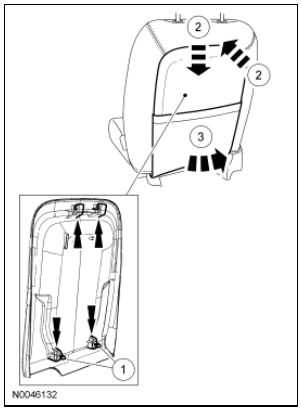
1. Position the affected seat to the full forward and upright position.

2. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

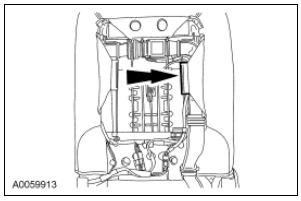
3. ***NOTICE:*** **The backrest trim panel must be inspected for cracked or broken upper hooks and lower retainer bosses. Remove and discard the lower pin-type retainers before inspecting the lower trim panel bosses. If any hook or boss is damaged a new backrest trim panel must be installed. Always install new pin-type retainers when installing a backrest trim panel.**

   Remove the seat backrest trim panel.

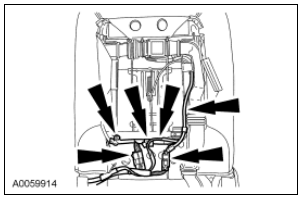
   1. Use an appropriate tool to release the 2 pin-type retainers at the lower bosses of the backrest trim panel.
   2. Push forward on the top of the backrest panel and slide it downward to release the upper hooks.
   3. Continue to push forward on the top of the backrest trim panel while rotating the bottom a few inches rearward to disengage the upper hook barbs.



4. Release the trim cover J-clip over the climate control duct (if equipped).

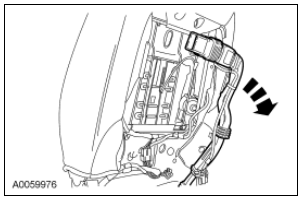


5. Disconnect the electrical connectors and separate all wire harness pin-type retainers from the lower seat back frame.

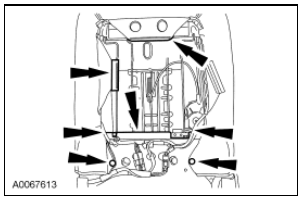


6. If equipped with climate control seats remove the pin-type retainer from the climate control duct.

7. If equipped with climate control seats remove the climate control duct.



8. Detach all the seat back trim cover J-clips and pin-type retainers.

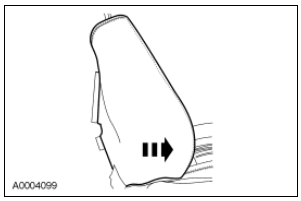


9. Remove the side air bag module nut cover.

10. **NOTE:** If installing a new side air bag module, use new retaining nuts. If the same side air bag module is to be reused then reuse the side air bag module nuts.

Remove the side air bag module nuts.

11. With one hand on the side air bag module, position the seat back trim cover and pad forward enough to access the side air bag module.



12. Disconnect and remove the side air bag module.

Installation

1. Connect the side air bag module electrical connector.

2. **⚠ WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.**

   ⚠ WARNING: Inspect the side air bag deployment chute and the side air bag cavity in the seat back pad for any foreign objects. If any foreign objects are found remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

   ⚠ WARNING: Before installing the side air bag module into the deployment chute, check it for damage and foreign objects. If the air bag module is damaged, replace it. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

   ⚠ WARNING: If the air bag cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment

   ⚠ WARNING: Check the side air bag deployment chute for damage. The deployment chute must not be repaired. If there is any damage to the deployment chute, the seat back trim cover and deployment chute must be installed new as a unit.

   ⚠ WARNING: If the air bag deployment chute is not properly positioned, the side air bag may not deploy correctly.

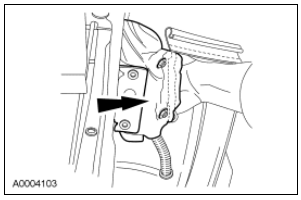
   ⚠ WARNING: Inspect the mounting surfaces of the deployment chute and the seat back frame mounting bracket for any foreign objects, before installing the side air bag module/deployment chute assembly. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

   NOTE: The alignment pin will only allow the side air bag module to be installed to the seat back mounting bracket one way.

   NOTE: Make sure the electrical connector is securely fastened to the side air bag module before installing the air bag module into the deployment chute.

   Position the side air bag module into the deployment chute.

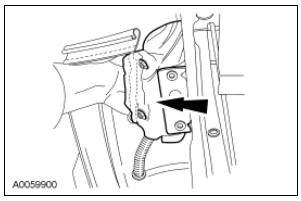
- Position the side air bag module into the deployment chute with the alignment pin offset to the top and the electrical connector to the bottom of the seat back to properly position the alignment pin correctly when the side air bag module and deployment chute are mounted to the seat back frame mounting bracket.
- The side air bag module mounting studs must come through the deployment chute stud openings.



3. **NOTE:** The deployment chute should not have any wrinkles or folds where it contacts the seat back frame mounting bracket.

   Install the side air bag module onto the front seat back frame mounting bracket and install the nuts.

   - Tighten to 9 Nm (80 lb-in).

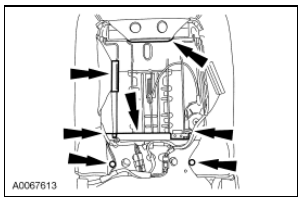


4. Reposition the seat back pad and trim cover to the seat back frame.

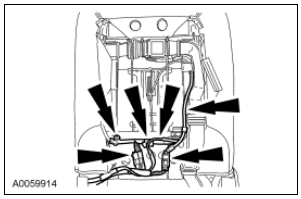
5. **NOTE:** Check that all 3 attaching clips on the side air bag nuts cover are correctly installed around the side air bag mounting bracket

   Attach the side air bag nuts cover.

6. Fasten the seat back trim cover J-clips.

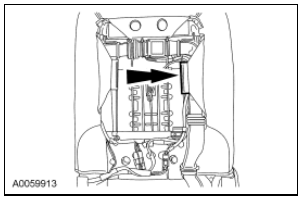


7. Connect the electrical connectors and attach all pin-type retainers to the lower seat back frame.

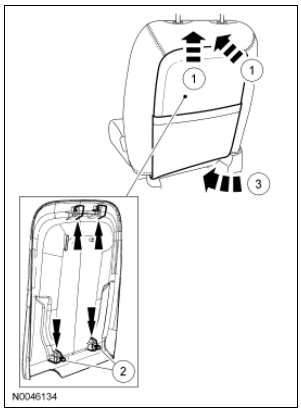


8. If equipped with climate control seats, install the climate control duct and the pin-type retainer.

9. Fasten the trim cover J-clip over the climate control duct (if equipped).

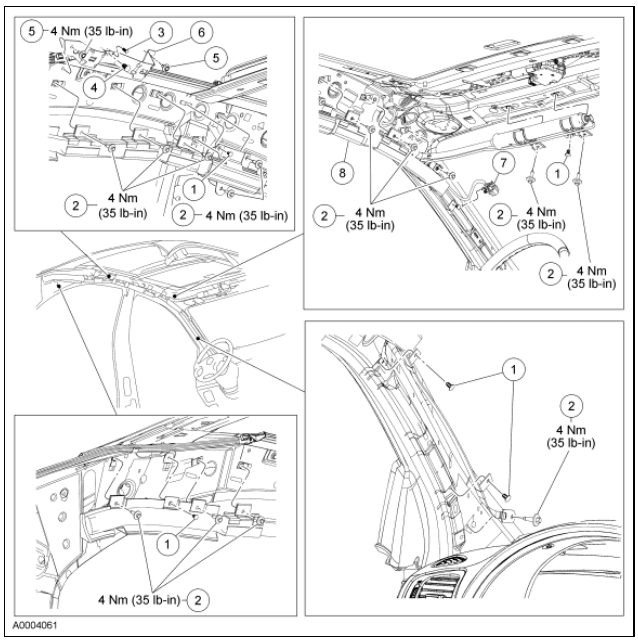


10. Install the seat backrest trim panel.
    1. Position the top of the backrest trim panel at an angle to the backrest frame and push it forward and slide it upward to engage the upper hooks.
    2. Continue positioning the backrest trim panel upward and align the 2 lower pin-type retainers with the holes in the backrest frame.
    3. Push the bottom of the backrest trim panel forward and seat the 2 pin-type retainers.



11. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Side Air Curtain Module



Item	Part Number	Description
1	W705635-S	Pin-type retainers (5 required)
2	W503924-S	Side air curtain retaining screws (13 required)
3	—	Pin-type retainer (part of 54312A52)
4	—	Pin-type retainer (part of 54312A52)
5	—	Screws
6	54312A53	Grab handle bracket
7	—	Side air curtain module electrical connector (part of 14A005)
8	54042D95	Side air curtain module

Removal

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: To reduce the risk of personal injury from an accidental deployment, always carry or place a live side air curtain module with the curtain and tear seam pointed away from your body. Failure to do so can result in personal injury in the event of a side air curtain deployment.

⚠ WARNING: After deployment, the surface of the side air curtain can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

⚠ WARNING: Never probe the connector on the side air curtain module. Doing so can result in side air curtain deployment which can result in personal injury.

⚠ WARNING: Anytime the side air curtain has deployed, the headliner, and all A, B, and C pillar upper trim panels and attaching hardware must be installed new along with any other damaged components and hardware. Failure to do so can result in personal injury in the event of a side air curtain deployment.

⚠ WARNING: Vehicles equipped with side air curtain modules require a specific headliner. When installing a new headliner on a vehicle equipped with side air curtain modules, make sure a headliner for side air curtain modules is being used. The word "AIRBAG" will appear on the headliner where it meets each B-pillar trim panel. Failure to do so can result in personal injury in the event of a side air curtain module deployment.

⚠ WARNING: Before installing a side air curtain module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. All fasteners must be replaced and any foreign objects removed. Failure to do so may result in personal injury in the event of a side air curtain deployment.

⚠ WARNING: The side air curtain must be installed in the vehicle using new torque-prevailing type U-nuts, part number W709759 or W520822. Use of this U-nut is mandatory so as to reduce the risk of loss of fastener effectiveness. Failure to follow these instructions may result in personal injury in the event of a side air curtain deployment.

⚠ WARNING: Inspect the side air curtain module before installation. If the side air curtain module is damaged or the cover has separated and the curtain material has been exposed, a new side air curtain module must be installed. Do not attempt to repair the side air curtain module. Failure to follow these instructions can result in personal injury in the event of a side air curtain module deployment.

⚠ WARNING: To reduce the risk of injury, do not obstruct or place objects in the deployment path of the side air curtain module. Failure to follow these instructions can result in personal injury in the event of a side air curtain module deployment.

⚠ WARNING: Never put any type of fastener or tie strap around any part of the side air curtain module or interior trim panel. This will prevent the side air curtain module from deploying correctly. Failure to do so can result in personal injury in the event of a side air curtain module deployment.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

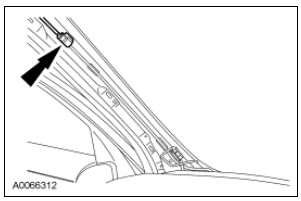
NOTE: Driver side shown, passenger side similar.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

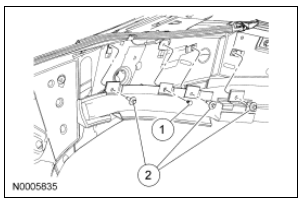
2. **⚠ WARNING: Anytime the side air curtain has deployed, the headliner, and all A-, B-, and C-pillar upper trim panels and attaching hardware must be replaced along with any other damaged components and hardware. Failure to do so may result in personal injury in the event of a side air curtain deployment.**

Remove the headliner. For additional information, refer to Section 501-05 .

3. Disconnect and detach the side air curtain module electrical connector located at the A-pillar.



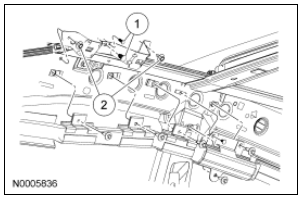
4. Remove the side air curtain module retainers near the C-pillar.
    1. Remove the pin-type retainer.
    2. Remove the 3 screws.



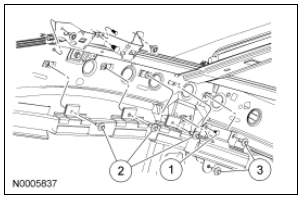
5. **NOTE:** If the side air curtain is being serviced on the passenger side, remove the front row bracket also.

   Remove the grab handle bracket located above the rear door.

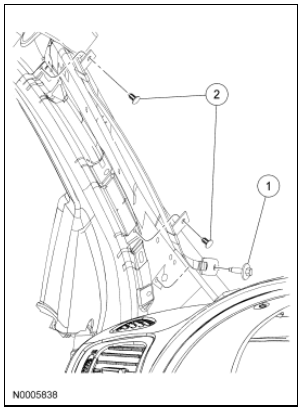
    1. Remove the 2 pin-type retainers.
    2. Remove the 2 screws and the grab handle bracket.



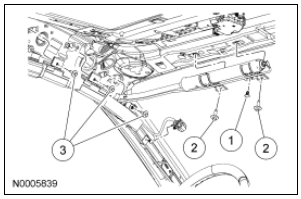
6. Remove the side air curtain module retainers located near the B-pillar.
    1. Remove the pin-type retainer.
    2. Remove the 3 screws.
    3. Remove the 2 screws.



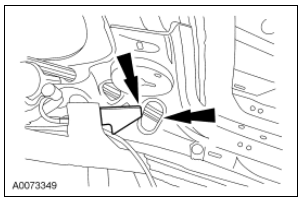
7. Remove the A-pillar tether retainers.
    1. Remove the screw.
    2. Remove the 2 pin-type retainers.



8. Remove the remaining side air curtain module retainers located near the A-pillar.
    1. Remove the side air curtain module canister pin-type retainer.
    2. Remove the 2 side air curtain module canister screws.
    3. Remove the 3 side air bag module screws.



9. Release the side air curtain module alignment ear located through the sheet metal opening at the top of the A-pillar and remove the side air curtain.



Installation

1. **⚠ WARNING: The side air curtain must be installed in the vehicle using new torque-prevailing type U-nuts, part number W709759 or W520822. Use of this U-nut is mandatory so as to reduce the risk of loss of fastener effectiveness. Failure to follow these instructions may result in personal injury in the event of a side air curtain deployment.**

   Remove all U-nut fasteners and install new.

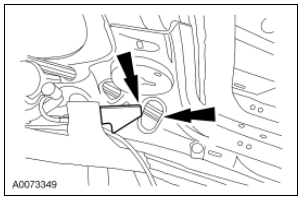
2. **⚠ WARNING: Before installing the side air curtain module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. Install new fasteners and remove any foreign objects. Failure to do so may result in personal injury in the event of a side air curtain deployment.**

   ⚠ WARNING: Before installing the side air curtain module, if the module is damaged or the cover has separated or the side air curtain material has been exposed, install a new side air curtain module. Do not attempt to repair the side air curtain. Failure to follow these instructions could result in personal injury in the event of a side air curtain deployment.

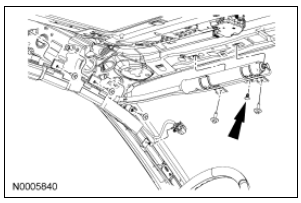
   ⚠ WARNING: Never put any type of fastener or tie strap around any part of the side air curtain module or interior trim panel. This will prevent the side air curtain module from

deploying correctly. Failure to do so can result in personal injury in the event of a side air curtain module deployment.

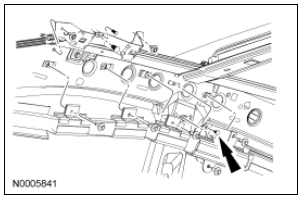
Align and install the side air curtain module alignment ear into the sheet metal opening at the top of the A-pillar.



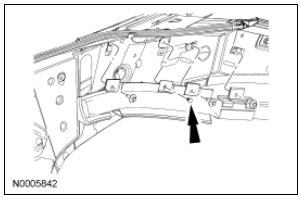
3. Install the side air curtain module canister pin-type retainer.



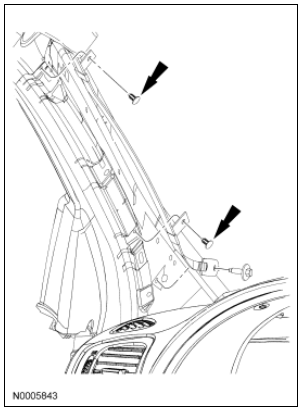
4. Install the side air curtain module pin-type retainer.



5. Install the side air curtain module pin-type retainer.



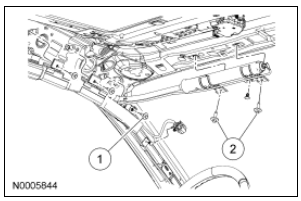
6. Install the 2 A-pillar tether pin-type retainers.



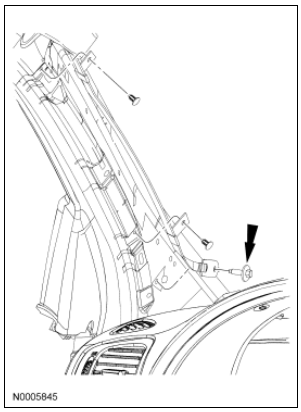
7. Install the side air curtain module screws located near the A-pillar.
    1. Install the side air curtain module screw.

♦ Tighten to 4 Nm (35 lb-in).

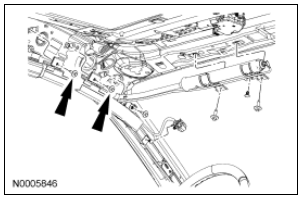
2. Install the 2 side air curtain module canister screws.
   ♦ Tighten to 4 Nm (35 lb-in).



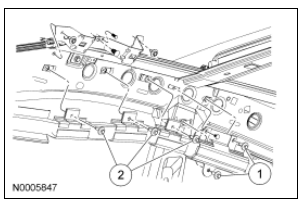
8. Install the A-pillar tether anchor screw.
   • Tighten to 4 Nm (35 lb-in).



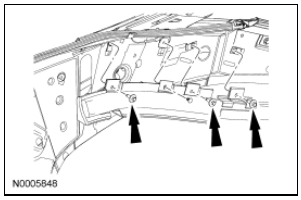
9. Install the 2 side air curtain module screws.
   • Tighten to 4 Nm (35 lb-in).



10. Install the side air curtain module screws located near the B-pillar.
    1. Install the 2 screws.
       ♦ Tighten to 4 Nm (35 lb-in).
    2. Install the 3 screws.
       ♦ Tighten to 4 Nm (35 lb-in).



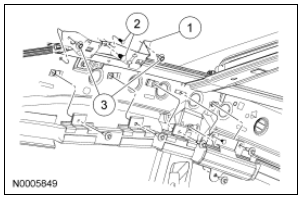
11. Install the 3 side air curtain module screws located near the C-pillar.
    • Tighten to 4 Nm (35 lb-in).



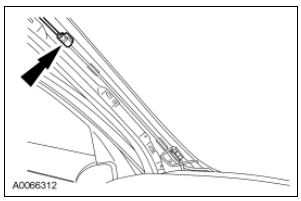
12. **NOTE:** If the side air curtain is being serviced on the passenger side, install the front row bracket also.

    Install the grab handle bracket.

    1. Position the grab handle bracket.
    2. Install the 2 pin-type retainers.
    3. Install the 2 screws.



13. Connect the side air curtain module electrical connector.

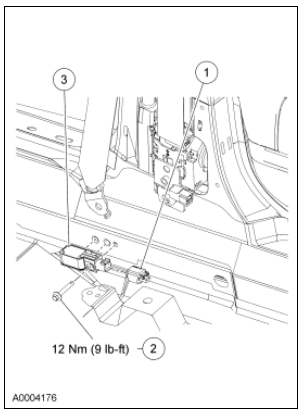


14. ⚠ **WARNING: Anytime the side air curtain has deployed, the headliner, and all A-, B-, and C-pillar upper trim panels and attaching hardware must be replaced along with any other damaged components and hardware. Failure to do so may result in personal injury in the event of a side air curtain deployment.**

    Install the headliner. For additional information, refer to Section 501-05 .

15. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Side Impact Sensor — First Row, B-Pillar



Item	Part Number	Description
1	—	Side impact connector (part of 14A005)
2	W707305-S	Side impact bolt
3	14B345	Side impact sensor

Removal

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and correctly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Passenger side shown, driver side similar.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Remove the front seat on the side with the affected B-pillar side impact sensor and depower the system. For additional information, refer to Section 501-10 .

2. **NOTE:** The B-pillar side impact sensor is located under the carpet on the inboard side of the rocker panel.

   Remove the B-pillar trim panel. For additional information, refer to Section 501-05 .

3. Disconnect the side impact sensor electrical connector.
4. Remove the side impact sensor bolt.
5. Remove the side impact sensor.

Installation

1. **NOTE:** Align the locator tabs of the side impact sensor to the openings in the rocker panel sheet metal.

   Install the B-pillar side impact sensor.

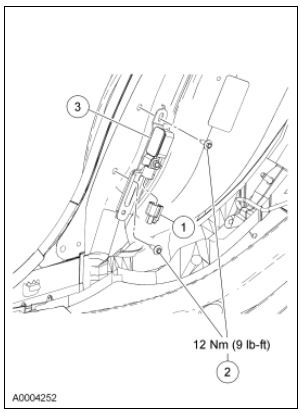
2. ⚠ **WARNING: The tightening torque of the air bag side impact sensor retaining bolt is critical for correct system operation.**

   Install the side impact sensor bolt.

   - Tighten to 12 Nm (9 lb-ft).

3. Connect the side impact sensor electrical connector.
4. Install the B-pillar trim panel. For additional information, refer to Section 501-05 .
5. Install the front seat on the side with the affected B-pillar side impact sensor . For additional information, refer to Section 501-10 .
6. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
7. Check the active restraint system for correct operation. For additional information, refer to section Section 501-20A .

Side Impact Sensor — Second Row, C-Pillar



Item	Part Number	Description
1	—	Side impact sensor connector (part of 14A005)
2	W707935- S437M	Side impact sensor bolts (2 required)
3	14B345	Side impact sensor

Removal

⚠ WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

⚠ WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and correctly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.

⚠ WARNING: To reduce the risk of personal injury, do not use any memory saver devices.

NOTE: The air bag warning lamp illuminates when the RCM fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

NOTE: Passenger side shown, driver side similar.

1. Depower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

2. Remove the rear seat bolster on the side with the affected C-pillar side impact sensor. For additional information, refer to Section 501-10 .

3. Disconnect the side impact sensor electrical connector.

4. Remove the 2 side impact sensor bolts.

5. Remove the side impact sensor.

Installation

1. **NOTE:** Align the locator tab of the second row side impact sensor mounting bracket to the opening in the C-pillar sheet metal.

   Install the C-pillar side impact sensor.

2. ⚠ **WARNING: The tightening torque of the air bag side impact sensor retaining bolts is critical for correct system operation.**

   Install the side impact sensor bolts.

   - Tighten to 12 Nm (9 lb-ft).

3. Connect the side impact sensor electrical connector.

4. Install the rear seat bolster on the side with the affected C-pillar side impact sensor. For additional information, refer to Section 501-10 .

5. Repower the system. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

6. Check the active restraint system for correct operation. For additional information, refer to Section 501-20A .

Torque Specifications

Description	Nm	lb-ft	lb-in
Air conditioning (A/C) line bracket bolt	10	—	89
Engine crossmember bolts	90	66	—
Engine mount nuts	63	46	—
Front/rear control arm cam bolts and nuts	175	129	—
Front stabilizer bar link nuts	55	41	—
I-brace bracket shoulder bolts	30	22	—
I-brace front bolts	55	41	—
I-brace rear bolts	30	22	—
Radiator support crossmember bolts	103	76	—
Rear brake line bracket bolt	20	15	—
Rear brake line fitting	20	15	—
Rear strut bolts	133	98	—
Rear subframe bolts	103	76	—
Steering gear bolts and nuts	103	76	—

Subframe and Mounting Systems

Radiator Support Crossmember

The radiator support crossmember is bolted to the body and is used to:

- aid in structural support.
- provide mounting surfaces for the front of the front suspension control arms.
- provide a mounting point for the front stabilizer bar.
- support the radiator.

Engine Support Crossmember

The engine support crossmember is bolted to the body and is used to:

- aid in structural support.
- provide mounting surfaces for the rear of the front suspension control arms.
- provide a mounting point for the engine isolators.
- provide a mounting point for the underbody stiffener.

Front I-Brace and Bracket Assembly

The I-brace and bracket assemblies are bolted to the body and the engine crossmember and are used to:

- provide support for the engine crossmember.
- stiffen the underbody.

Rear Subframe

The rear subframe is bolted to the body and is used to:

- aid in structural support.
- provide mounting surfaces for the rear suspension bar.
- provide mounting surfaces for the rear axle differential.
- provide a mounting point for the rear stabilizer.

If the rear subframe bushings become worn or damaged a new rear subframe must be installed as a unit. New rear subframe bushings cannot be installed.

Body Misalignment Check

⚠ CAUTION: Do not attempt to correct any serious misalignment with 1 pulling/pushing operation. Damage to the structure may occur.

⚠ CAUTION: In case of severe or sharp bends, it may be necessary to use heat. Any attempt to cold-straighten a severely bent bracket may cause ruptures of the welds. It may also cause cracks in the bent part. Never heat the area to more than 650°C (1,202°F). Always use temperature-indicating crayons when applying heat to any part.

NOTE: All measurements should be made from the bare metal; remove the trim and bumper covers as necessary.

1. Repair the badly damaged areas before taking measurements for underbody alignment.

2. To check the underbody alignment, take the measurements between opposite reference points, such as crease lines or weld joints.

3. Monitor the upper body structure for excessive stress or movement while making any corrections to the underbody structure. Remove the windshield glass and rear window glass to prevent breakage. For additional information, refer to Section 501-11 .

Underbody Misalignment Check

1. The dimensions of the underbody must be restored to provide the correct front and rear wheel alignment geometry.

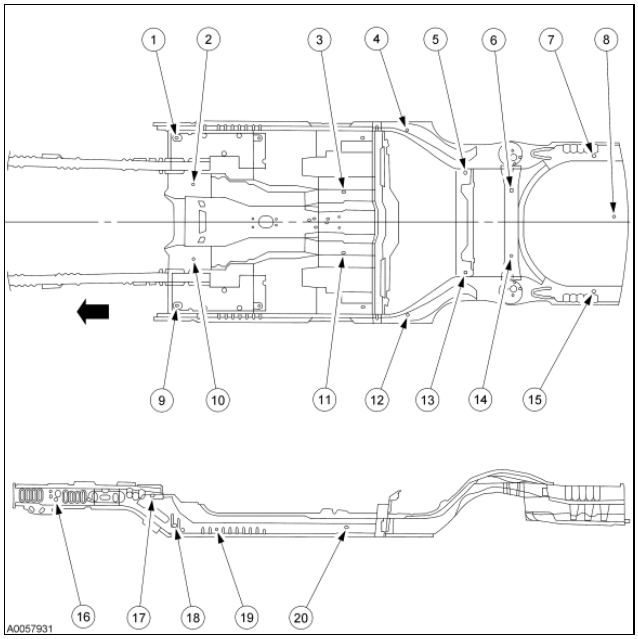
2. All the dimensions are measured between the centers of the existing holes in the underbody unless otherwise specified.

3. Inspect all underbody structural members for cracks, twists or bends. Check all welded connections for cracks. Inspect the support brackets for looseness. Carry out any necessary repairs or install new components as necessary.

4. The X axis is referenced from the front of the vehicle. The Y axis is referenced from the center line of the vehicle.

Underbody Dimensions

Dimension	X axis mm (in)	Y axis mm (in)
1	2,044.59 mm (80.495 in)	614 mm (24.173 in)
2	2,164 mm (85.196 in)	273 mm (10.748 in)
3	3,258 mm (128.267 in)	224 mm (8.818 in)
4	3,725 mm (146.653 in)	675 mm (26.574 in)
5	4,150 mm (163.385 in)	365 mm (14.37 in)
6	4,490 mm (176.771 in)	240 mm (9.448 in)
7	5,100 mm (200.787 in)	500 mm (19.685 in)
8	5,250 mm (206.692 in)	50 mm (1.968 in)
9	2,044.59 mm (80.495 in)	614 mm (24.173 in)
10	2,164 mm (85.196 in)	273 mm (10.748 in)
11	3,258 mm (128.267 in)	224 mm (8.818 in)
12	3,725 mm (146.653 in)	675 mm (26.574 in)
13	4,150 mm (163.385 in)	365 mm (14.37 in)
14	4,490 mm (176.771 in)	240 mm (9.448 in)
15	5,100 mm (200.787 in)	500 mm (19.685 in)
16	1,118 mm (44.015 in)	—
17	1,825 mm (71.85 in)	—
18	1,990 mm (78.346 in)	—
19	2,300 mm (90.551 in)	—
20	3,258 mm (128.267 in)	—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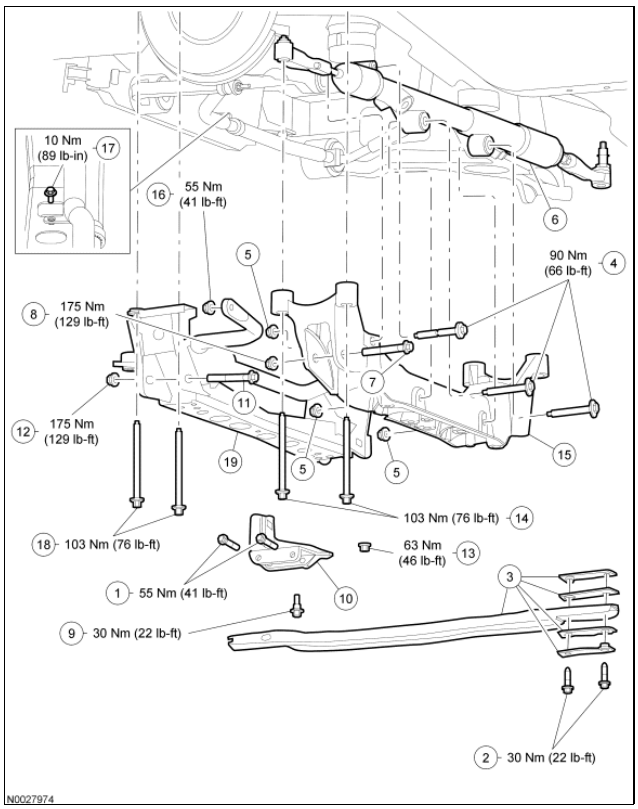
Subframe and Components — Exploded View, Front

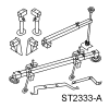


Item	Part Number	Description
1	N804518-S100	I-brace front bolts (2 each side)
2	W707186-S439	I-brace rear bolts (2 each side)
3	5A099/ 5A098	I-brace (LH/RH)
4	W708659-S439	Steering gear bolts (3 required)
5	W520214-S440	Steering gear nuts (3 required)
6	3504	Steering gear
7	W706993-S439	Rear control arm cam bolts (2 each side)
8	W520215-S440	Rear control arm cam nuts (2 each side)
9	W707308-S439	I-brace bracket shoulder bolt
10	5A143/ 5A144	I-brace bracket (LH/RH)
11	W706993-S439	Front control arm cam bolts (2 each side)
12	W520215-S440	Front control arm cam nuts (2 each side)
13	N621942-S421	Engine mount nuts (2 required)
14	W706329-S439	Engine crossmember bolts (4 required)
15	5026	Engine crossmember
16	W520213-S440	Front stabilizer bar link nuts (2 required)
17	W705968	Air conditioning (A/C) line bracket bolt
18	W708091-S439	Radiator support crossmember bolts
19	5019	Radiator crossmember

1. For additional information, refer to the procedures in this section.

Crossmember — Engine

Special Tool(s)

 ST2333-A	Three Bar Engine Support Kit 303-F072

Removal and Installation

⚠ **CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major repair expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTE: New control arm cam bolts and nuts must be installed whenever they are removed from the lower control arm.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Using the special tool, support the engine.

3. Remove the front tire and wheel assemblies. For additional information, refer to Section 204-04 .

4. **NOTE:** When installing, loosely install the front bolts and then the rear bolts. With the vehicle at curb height, tighten the bolts to the specifications.

   Remove the LH I-brace 2 front bolts.

   - To install, tighten to 55 Nm (41 lb-ft).

5. Remove the LH I-brace 2 rear bolts.
   - To install, tighten to 30 Nm (22 lb-ft).

6. **NOTE:** When installing, loosely install the front bolts and then the rear bolts. With the vehicle at curb height, tighten the bolts to the specifications.

   NOTE: When installing the rear bolts, make sure the insulators (4 per side) are properly installed.

   Remove the RH I-brace 2 front bolts.

   - To install, tighten to 55 Nm (41 lb-ft).

7. Remove the RH I-brace 2 rear bolts.
   - To install, tighten to 30 Nm (22 lb-ft).

8. **NOTE:** When installing, use new steering gear nuts.

Remove the 3 nuts and bolts and position the steering gear aside.

- To install, tighten to 90 Nm (66 lb-ft).

9. **NOTE:** When installing, loosely install the bolts. With the vehicle at curb height, tighten the bolts to the specification.

   NOTE: When installing, use new rear control arm cam bolts and nuts.

   Remove the 2 rear control arm cam bolts and nuts (1 cam bolt and nut per side).

   - To install, tighten to 175 Nm (129 lb-ft).

10. Remove the LH I-brace bracket shoulder bolt.
    - To install, tighten to 30 Nm (22 lb-ft).

11. Remove the LH I-brace bracket.

12. Remove the RH I-brace bracket shoulder bolt.
    - To install, tighten to 30 Nm (22 lb-ft).

13. Remove the RH I-brace bracket.

14. Remove the 2 engine mount nuts.
    - To install, tighten to 63 Nm (46 lb-ft).

15. **NOTE:** When installing, use new engine crossmember bolts.

    Remove the 4 engine crossmember bolts (2 per side) and remove the engine crossmember.

    - To install, tighten to 103 Nm (76 lb-ft).

16. **NOTE:** A front wheel alignment is required when the crossmember or any of the control arm cam bolts and nuts are removed. For additional information, refer to Section 204-00 .

    To install, reverse the removal procedure.

Crossmember

Removal and Installation

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major repair expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: New control arm cam bolts and nuts must be installed whenever they are removed from the lower control arm.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the front tire and wheel assemblies. For additional information, refer to Section 204-04 .

3. Remove the front valance panels.

4. Remove the radiator sight shield.

5. When removing the radiator crossmember, support the radiator.

6. **NOTE:** When installing, loosely install the front bolts and then the rear bolts. With the vehicle at curb height, tighten the bolts to the specifications.

   Remove the LH I-brace 2 front bolts.

   - To install, tighten to 55 Nm (41 lb-ft).

7. Remove the LH I-brace 2 rear bolts.
   - To install, tighten to 30 Nm (22 lb-ft).

8. **NOTE:** When installing, loosely install the front bolts and then the rear bolts. With the vehicle at curb height, tighten the bolts to the specifications.

   NOTE: When installing the rear bolts, make sure the insulators (4 per side) are properly installed.

   Remove the RH I-brace 2 front bolts.

   - To install, tighten to 55 Nm (41 lb-ft).

9. Remove the RH I-brace 2 rear bolts.
   - To install, tighten to 30 Nm (22 lb-ft).

10. Remove the LH I-brace bracket shoulder bolt.
    - To install, tighten to 30 Nm (22 lb-ft).

11. Remove the LH I-brace bracket.

12. Remove the RH I-brace bracket shoulder bolt.
    - To install, tighten to 30 Nm (22 lb-ft).

13. Remove the RH I-brace bracket.

14. **NOTE:** When installing, loosely install the bolts. With the vehicle at curb height, tighten the bolts to the specification.

    NOTE: When installing, use new front control arm cam bolts and nuts.

    Remove the 2 front control arm cam bolts and nuts (1 cam bolt and nut per side).

    - To install, tighten to 175 Nm (129 lb-ft).

15. **NOTE:** When installing, use new sway brace link nuts.

    Remove the 2 front stabilizer bar link nuts (1 per side).

    - To install, tighten to 55 Nm (41 lb-ft).

16. Remove the air conditioning (A/C) line bracket bolt.
    - To install, tighten to 10 Nm (89 lb-in).

17. **NOTE:** When installing, use new radiator crossmember bolts.

    Remove the 4 radiator support crossmember bolts (2 per side).

    - To install, tighten to 103 Nm (76 lb-ft).

18. **NOTE:** If equipped, disconnect the block heater cable from the crossmember.

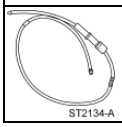
    Remove the radiator crossmember.

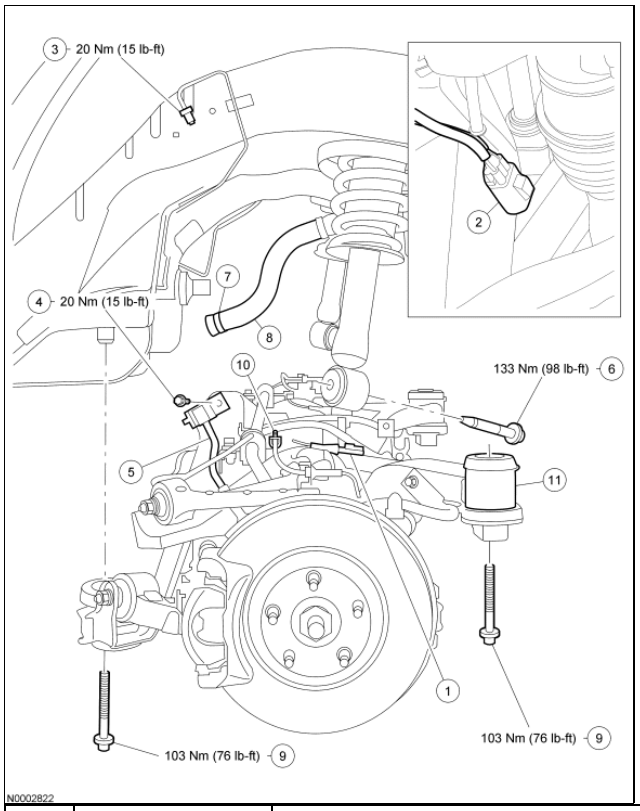
19. **NOTE:** A front wheel alignment is required when the crossmember or any of the control arm cam bolts and nuts are removed. For additional information, refer to Section 204-00 .

    To install, reverse the removal procedure.

Subframe — Rear

Special Tool(s)

ST1134A	Fuel Storage Tank 164-R3202 or equivalent
 ST2134-A	Fuel Drain Hose 310-102



Item	Part Number	Description
1	2C190	Anti-lock brake system (ABS) sensor electrical connectors (2 required)
2	14A464	Electric parking brake electrical connectors (2 required)
3	—	Rear brake line fittings (part of 2C287) (2 required)
4	N802191	Rear brake line bracket bolts (2 required)
5	2A442	Rear brake lines (2 required)
6	W704884-S439	Rear strut bolts (2 required)
7	N808238	Fuel filler hose clamp
8	9047	Fuel filler hose
9	W706614-S439	Rear subframe bolts (4 required)

10	—	ABS sensor electrical cable locator
11	5D042	Subframe and bushings assembly

Removal and Installation

⚠ WARNING: Use of any other than approved DOT 3 or DOT 4 brake fluid may cause permanent damage to brake components and may render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it off with water.

⚠ CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with the specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** Drain fuel from the fuel filler pipe only. It is not necessary to drain the entire fuel system.

   Drain the fuel from the fuel tank filler pipe. For additional information, refer to Section 310-00 .

3. **NOTE:** If a new rear subframe is to be installed, the differential and halfshafts must be removed prior to removal of the rear subframe. For all other procedures, the differential, halfshafts and rear subframe are to be removed as an assembly.

   If installing a new subframe, remove the rear axle differential case. For additional information, refer to Section 205-02 .

4. Remove the drive shaft. For additional information, refer to Section 205-01 .

5. Remove the rear wheel and tire assemblies. For additional information, refer to Section 204-04 .

6. Disconnect the ABS sensor connectors (1 per side).

7. Disconnect the electric parking brake connectors (1 per side).

8. **NOTE:** Make sure to cap off all fluid lines and hoses.

   NOTE: After the subframe is installed, bleed the brake system. For additional information, refer to Section 206-00 .

   Remove the 2 rear brake line fittings (1 per side).

   - To install, tighten to 20 Nm (15 lb-ft).

9. Remove the 2 rear brake line bracket bolts.
   - To install, tighten to 20 Nm (15 lb-ft).

10. Remove the 2 rear strut bolts (1 per side).
    - To install, tighten to 133 Nm (98 lb-ft).

11. **NOTE:** Make sure to cap off all fluid lines and hoses.

    Remove the hose clamp from the fuel filler hose.

12. ⚠ **CAUTION: Prior to the removal of the fuel filler pipe, care must be taken to avoid spillage of any residual fuel.**

    Remove the fuel filler pipe from the fuel tank.

13. **NOTE:** Paint or mark the position of the subframe to the body for assembly reference.

    Remove the 4 rear subframe bolts (2 per side).

    - To install, tighten to 103 Nm (76 lb-ft).

14. Remove the ABS sensor electrical cable locator.

15. ⚠ **CAUTION: Make sure to not damage the fuel tank when lowering or raising the subframe assembly.**

    NOTE: If installing a new subframe, transfer the park brake assembly. For additional information, refer to Section 206-05 .

    NOTE: If installing a new subframe and bushings assembly, center the subframe on the body mounts.

    NOTE: If installing a new subframe and bushings assembly, transfer all the suspension components and perform a rear wheel alignment. For additional information, refer to Section 204-00 .

    Remove the subframe and bushings assembly.

16. To install, reverse the removal procedure.

General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Gasoline Engine Oil Dye 164-R3705	—
Threadlock 262 TA-26	WSK-M2G351-A6

Engine

NOTICE: **When repairing engines, all parts must be contamination free. If contamination/foreign material is present when repairing an engine, premature engine failure may occur.**

NOTE: Specifications show the expected minimum or maximum condition. Refer to the appropriate section in Group 303 for the procedure.

NOTE: If a component fails to meet the specifications, it is necessary to refinish it or install a new component. Wear limits are provided as an aid to determine if the component can be refinished. A new component must be installed when any component fails to meet specifications and cannot be refinished.

NOTE: This section contains information, steps and procedures that may not be specific to this engine.

This section covers general procedures and diagnosis and testing of the engine system, except for exhaust emission control devices, which are covered in the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

The engine incorporates the following features: Refer to the appropriate section in Group 303 for the procedure.

- Crankcase ventilation or breather system
- Exhaust emission control system
- Evaporative Emission (EVAP) control system

Some engines incorporate a fail-safe cooling system. Refer to the appropriate section in Group 303 for the procedure.

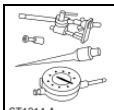
The engine, fuel system, ignition system, emissions system and exhaust system all affect exhaust emission levels and must be maintained according to the maintenance schedule. Refer to the scheduled Maintenance Guide.

Correct engine identification is required to order parts. Refer to the appropriate section in Group 303 for the procedure.

For complete vehicle and engine identification codes, refer to Section 100-01 .

Engine

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1296-A	Oil Pressure Gauge 303-088 (T73L-6600-A)
ST1300-A	12 Volt Master UV Diagnostic Inspection Kit 164-R0756 or equivalent (Leak Detector)
ST1297-A	Vacuum/Pressure Tester 164-R0253 or equivalent

Inspection and Verification

1. Verify the customer concern by operating the engine to duplicate the condition.
2. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical
• Engine coolant leaks • Engine oil leaks • Fuel leaks • Damaged or severely worn parts • Loose mounting bolts, studs and nuts

3. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.
4. If the concerns remain after the inspection, determine the symptoms. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Component Tests

Engine Oil Leaks

NOTE: When diagnosing engine oil leaks, the source and location of the leak must be positively identified prior to repair.

Prior to carrying out this procedure, clean the cylinder block, cylinder heads, valve covers, oil pan and flywheel with a suitable solvent to remove all traces of oil.

Engine Oil Leaks — Fluorescent Oil Additive Method

Use the 12 Volt Master UV Diagnostic Inspection Kit to carry out the following procedure for oil leak diagnosis.

1. Clean the engine with a suitable solvent to remove all traces of oil.

2. Add Gasoline Engine Oil Dye 164-R3705 meeting Ford specification ESE-M99C103-B1 or equivalent to the engine oil. Use a minimum 14.8 ml (0.5 ounce) to a maximum 40 ml (1.35 ounce) of fluorescent additive to all engines.

3. Run the engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using the 12 Volt Master UV Diagnostic Inspection Kit. A clear bright yellow or orange area will identify the leak. For extremely small leaks, several hours may be necessary for the leak to appear.

Leakage Points — Underhood

Examine the following areas for oil leakage:

- Valve cover gaskets
- Cylinder head gaskets
- Oil cooler, if equipped
- Oil filter adapter
- Engine front cover
- Oil filter adapter and filter body
- Oil level indicator tube connection
- Oil pressure sensor

Leakage Points — Under Engine, With Vehicle on Hoist

Examine the following areas for oil leakage:

- Oil pan gaskets
- Oil pan sealer
- Sump sealer — 8 cylinder
- Engine front cover gasket
- Crankshaft front seal
- Crankshaft rear oil seal
- Oil filter adapter and filter body
- Oil cooler, if equipped

Leakage Points — With Transmission and Flywheel Removed

Examine the following areas for oil leakage:

- Crankshaft rear oil seal
- Rear main bearing cap parting line
- Flexplate mounting bolt holes (with flexplate installed)
- Pipe plugs at the end of oil passages

Oil leaks at crimped seams in sheet metal parts and cracks in cast or stamped parts can be detected when using the dye method.

Compression Test — Compression Gauge Check

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.

2. Set the throttle plates in the WIDE-OPEN position.

3. Install a compression gauge in the No. 1 cylinder.

4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes necessary to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test — Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75 percent of the highest reading. For additional information, refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1131 kPa (164 psi)	848 kPa (123 psi)	1338 kPa (194 psi)	1000 kPa (146 psi)	1544 kPa (224 psi)	1158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1145 kPa (166 psi)	855 kPa (124 psi)	1351 kPa (196 psi)	1014 kPa (147 psi)	1558 kPa (226 psi)	1165 kPa (169 psi)
952 kPa (138 psi)	717 kPa (104 psi)	1158 kPa (168 psi)	869 kPa (126 psi)	1365 kPa (198 psi)	1020 kPa (148 psi)	1572 kPa (228 psi)	1179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1172 kPa (170 psi)	876 kPa (127 psi)	1379 kPa (200 psi)	1034 kPa (150 psi)	1586 kPa (230 psi)	1186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1186 kPa (172 psi)	889 kPa (129 psi)	1303 kPa (202 psi)	1041 kPa (151 psi)	1600 kPa (232 psi)	1200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1200 kPa (174 psi)	903 kPa (131 psi)	1407 kPa (204 psi)	1055 kPa (153 psi)	1055 kPa (153 psi)	1207 kPa (175 psi)

1007 kPa (146 psi)	758 kPa (110 psi)	1214 kPa (176 psi)	910 kPa (132 psi)	1420 kPa (206 psi)	1062 kPa (154 psi)	1627 kPa (154 psi)	1220 kPa (177 psi)
1020 kPa (148 psi)	765 kPa (111 psi)	1227 kPa (178 psi)	917 kPa (133 psi)	1434 kPa (208 psi)	1075 kPa (156 psi)	1641 kPa (238 psi)	1227 kPa (178 psi)
1034 kPa (150 psi)	779 kPa (113 psi)	1241 kPa (180 psi)	931 kPa (135 psi)	1448 kPa (210 psi)	1083 kPa (157 psi)	1655 kPa (240 psi)	1241 kPa (180 psi)
1048 kPa (152 psi)	786 kPa (114 psi)	1255 kPa (182 psi)	936 kPa (136 psi)	1462 kPa (212 psi)	1089 kPa (158 psi)	1669 kPa (242 psi)	1248 kPa (181 psi)
1062 kPa (154 psi)	793 kPa (115 psi)	1269 kPa (184 psi)	952 kPa (138 psi)	1476 kPa (214 psi)	1103 kPa (160 psi)	1682 kPa (244 psi)	1262 kPa (183 psi)
1076 kPa (156 psi)	807 kPa (117 psi)	1282 kPa (186 psi)	965 kPa (140 psi)	1489 kPa (216 psi)	1117 kPa (162 psi)	1696 kPa (246 psi)	1269 kPa (184 psi)
1089 kPa (158 psi)	814 kPa (118 psi)	1296 kPa (188 psi)	972 kPa (141 psi)	1503 kPa (218 psi)	1124 kPa (163 psi)	1710 kPa (248 psi)	1202 kPa (186 psi)
1103 kPa (160 psi)	827 kPa (120 psi)	1310 kPa (190 psi)	979 kPa (142 psi)	1517 kPa (220 psi)	1138 kPa (165 psi)	1724 kPa (250 psi)	1289 kPa (187 psi)
1110 kPa (161 psi)	834 kPa (121 psi)	1324 kPa (192 psi)	993 kPa (144 psi)	1631 kPa (222 psi)	1145 kPa (166 psi)	—	—

If one or more cylinders reads low, squirt approximately one tablespoon of engine oil meeting Ford specification on top of the pistons in the low-reading cylinders. Repeat the compression pressure check on these cylinders.

Compression Test — Interpreting Compression Readings

1. If compression improves considerably, piston rings are worn or damaged.

2. If compression does not improve, valves are sticking or not seating correctly.

3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.
   Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75 percent of the highest reading.

Cylinder Leakage Detection

When a cylinder produces a low reading, use of a cylinder leakage tester will be helpful in pinpointing the exact cause.

The leakage tester is inserted in the spark plug hole, the piston is brought up to dead center on the compression stroke, and compressed air is admitted.

Once the combustion chamber is pressurized, the leakage tester gauge will read the percentage of leakage. Leakage exceeding 20 percent is excessive.

While the air pressure is retained in the cylinder, listen for the hiss of escaping air. A leak at the intake valve will be heard in the throttle body. A leak at the exhaust valve can be heard at the tailpipe. Leakage past the piston rings will be audible at the positive crankcase ventilation (PCV) connection. If air is passing through a blown head gasket to an adjacent cylinder, the noise will be evident at the spark plug hole of the cylinder into

which the air is leaking. Cracks in the cylinder block or gasket leakage into the cooling system may be detected by a stream of bubbles in the radiator.

Excessive Engine Oil Consumption

Nearly all engines consume oil, which is essential for normal lubrication of the cylinder bore walls and pistons and rings. Determining the level of oil consumption may require testing by recording how much oil is being added over a given set of miles.

Customer driving habits greatly influence oil consumption. Mileage accumulated during towing or heavy loading generates extra heat. Frequent short trips, stop-and-go type traffic or extensive idling, prevent the engine from reaching normal operating temperature. This prevents component clearances from reaching specified operating ranges.

The following diagnostic procedure may be utilized to determine internal oil consumption. Make sure that the concern is related to internal oil consumption, and not external leakage, which also consumes oil. Verify there are no leaks before carrying out the test. Once verified, the rate of internal oil consumption can be tested.

A new engine may require extra oil in the early stages of operation. Internal piston-to-bore clearances and sealing characteristics improve as the engine breaks in. Engines are designed for close tolerances and do not require break-in oils or additives. Use the oil specified in the Owner Guide. Ambient temperatures may determine the oil viscosity specification. Verify that the correct oil is being used for the vehicle in the geographic region in which it is driven.

Basic Pre-checks

1. For persistent complaints of oil consumption, interview the customer to determine the oil consumption characteristics. If possible, determine the brand and grade of oil currently in the oil pan. Look at the oil filter or oil-change station tags to determine if Ford-recommended maintenance schedules have been followed. Make sure that the oil has been changed at the specified mileage intervals. If vehicle mileage is past the first recommended drain interval, the OEM production filter should have been changed.

2. Ask how the most current mileage was accumulated. That is, determine whether the vehicle was driven under the following conditions:
    - Extended idling or curbside engine operation
    - Stop-and-go traffic or taxi operation
    - Towing a trailer or vehicle loaded heavily
    - Frequent short trips (engine not up to normal operating temperature)
    - Excessive throttling or high engine-rpm driving

3. Verify that there are no external leaks. If necessary, review the diagnostic procedure under Engine Oil Leaks in the Diagnosis and Testing portion of this section.

4. Inspect the crankcase ventilation system for:
    - disconnected hoses at the valve cover or throttle body.
    - loose or missing valve cover fill cap.
    - missing or incorrectly seated engine oil level indicator.
    - incorrect or dirty PCV valve.
    - a PCV valve grommet unseated in the valve cover (if so equipped)

5. Inspect for signs of sludge. Sludge affects PCV performance and can plug or restrict cylinder head drainback wells. It can also increase oil pressure by restricting passages and reducing the drainback

capability of piston oil control rings. Sludge can result from either excessive water ingestion in the crankcase or operation at extremely high crankcase temperatures.

6. Inspect the air filter for dirt, sludge or damage. A hole in the filter element will allow unfiltered air to bypass into the air induction system. This can cause premature internal wear (engine dusting), allowing oil to escape past rings, pistons, valves and guides.

7. If the engine is hot or was recently shut down, wait at least 5 minutes to allow the oil to drain back. Ask the customer if this requirement has been followed. Adding oil without this wait period can cause an overfill condition, leading to excessive oil consumption and foaming which may cause engine damage.

8. Make sure the oil level indicator (dipstick) is correctly and fully seated in the indicator tube. Remove the oil level indicator and record the oil level.

Detailed Pre-checks

1. Check the thermostat opening temperature to make sure that the cooling system is operating at the specified temperature. If it is low, internal engine parts are not running at specified internal operating clearances.

2. Verify the spark plugs are not oil saturated. Oil leaking into one or more cylinders will appear as an oil soaked condition on the plug. If a plug is saturated, a compression check may be necessary at the conclusion of the oil consumption test.

Oil Consumption Test

Once all of the previous conditions are met, carry out an oil consumption test.

1. Drain the engine oil and remove the oil filter. Install a new manufacturer-specified oil filter. Make sure the vehicle is positioned on a level surface. Refill the oil pan to a level **one quart (liter) less** than the specified fill level, using manufacturer-specified oil.

2. Run the engine for 3 minutes (if hot) or 10 minutes (if cold). Allow for a minimum 5-minute drainback period and then record the oil level shown on the oil level indicator. Place a mark on the backside of the oil level indicator noting the oil level location.

3. Add the final 1 quart (liter) to complete the normal oil fill. Restart the engine and allow it to idle for 2 minutes. Shut the engine down.

4. After a 5-minute drainback period, record the location of the oil level again. Mark the oil level indicator with the new oil level location. (Note: Both marks should be very close to the MIN-MAX upper and lower limits or the upper and lower holes on the oil level indicator. These marks will exactly measure the engine's use of oil, with a one quart differential between the new marks.) Demonstrate to the customer that the factory-calibrated marks on the dipstick are where the oil should fall after an oil change with the specified fill amount. Explain however, that this may vary slightly between MIN-MAX or the upper and lower holes on the oil level indicator.

5. Record the vehicle mileage.

6. Advise the customer that oil level indicator readings must be taken every 320 km (200 miles) or weekly, using the revised marks as drawn. Remind the customer that the engine needs a minimum 5-minute drainback for an accurate reading and that the oil level indicator must be firmly seated in the tube prior to taking the reading.

7. When the subsequent indicator readings demonstrate a full quart (liter) has been used, record the vehicle mileage. The mileage driven between the 2 readings should not be less than 1,500 miles. The drive cycle the vehicle has been operated under must be considered when making this calculation. It may be necessary to have the customer bring the vehicle in for a periodic oil level indicator reading to closely monitor oil usage.

Post Checks, Evaluation and Corrective Action

1. If test results indicate excessive oil consumption, carry out a cylinder compression test. The cylinder compression test should be carried out with a fully charged battery and all spark plugs removed. See the Compression Test Chart in this section for pressure range limits.

2. Compression should be consistent across all cylinders. For additional information, refer to the Compression Testing portion of this section. If compression tested within the specifications found in this section, the excessive oil consumption may be due to wear on the valve guides, valves or valve seals.

3. A cylinder leak detection test can be carried out using an Engine Cylinder Leak Detection/Air Pressurization Kit. This can help identify valves, piston rings or worn valve guides/valve stems, inoperative valve stem seals or other related areas as the source of oil consumption.

NOTE: An oil-soaked appearance on the porcelain tips of the spark plugs also indicates excessive oil use. A typical engine with normal oil consumption will exhibit a light tan to brown appearance. See Spark Plug Analysis in this section for details. A single or adjoining, multiple cylinder leak can be traced by viewing the tips.

4. If an internal engine part is isolated as the root cause, determine if the repair will exceed cost limits and proceed with a repair strategy as required.

5. Once corrective action to engine is complete and verifying that all pre-check items were eliminated in the original diagnosis, repeat the Oil Consumption Test as described above and verify consumption results.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect the Vacuum/Pressure Tester to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is conducted. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 feet) of elevation above sea level.

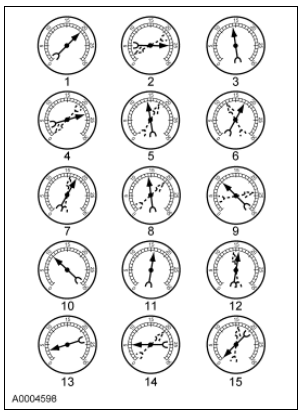
The reading should be steady. If necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

Intake Manifold Vacuum Test—Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.



1. NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.

2. NORMAL READING DURING RAPID ACCELERATION AND DECELERATION: When the engine is rapidly accelerated (dotted needle), the needle will drop to a low reading (not to zero). When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.

3. NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.

4. WORN RINGS OR DILUTED OIL: When the engine is accelerated (dotted needle), the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).

5. STICKING VALVES: When the needle (dotted) remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.

6. BURNED OR WARPED VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or warped valves. Insufficient valve clearance will also cause this reaction.

7. POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating.

8. WORN VALVE GUIDES: When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.

9. WEAK VALVE SPRINGS: When the needle oscillation becomes more violent as engine rpm is increased, weak valve springs are indicated. The reading at idle could be relatively steady.

10. LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.

11. IGNITION TIMING RETARDING: Retarded ignition timing will produce a steady but somewhat low reading.

12. INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.

13. INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.

14. BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head-to-cylinder block surface.

15. RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine rpm is increased, the back pressure caused by a clogged muffler, kinked tailpipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.

16. When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory unit such as the power brake booster, the unit will not function correctly. Always fix vacuum leaks.

Oil Pressure Test

1. Disconnect and remove the oil pressure sensor from the engine.

2. Connect the Engine Oil Pressure Gauge to the oil pressure sender oil galley port.

3. Run the engine until normal operating temperature is reached.

4. Run the engine at the specified rpm and record the gauge reading.

5. The oil pressure should be within specifications; For additional information, refer to the specification chart in the appropriate engine section.

6. If the pressure is not within specification, check the following possible sources:
    - Insufficient oil
    - Oil leakage
    - Worn or damaged oil pump
    - Oil pump screen cover and tube
    - Excessive main bearing clearance
    - Excessive connecting rod bearing clearance
    - VCT system leak
    - Chain tensioner leak

Valve Train Analysis — Engine Off, Valve Cover Removed

Check for damaged or severely worn parts and correct assembly. Make sure correct parts are used with the static engine analysis as follows.

Valve Train Analysis — Engine Off

- Check for loose mounting bolts on camshaft caps.
- Check valve shim to camshaft gap.

Valve Train Analysis — Engine Off, Camshaft — Engines

- Check for broken or damaged parts.

Valve Train Analysis — Valve Springs

- Check for broken or damaged parts.

Valve Train Analysis — Engine Off, Valve Spring Retainer and Valve Spring Retainer Keys

- Check for correct seating of the valve spring retainer key on the valve stem and in valve spring retainer.
- Check for correct seating on the valve stem.

Valve Train Analysis — Engine Off, Valves and Cylinder Head

- Check for plugged oil drain back holes.
- Check for worn or damaged valve tips.
- Check for missing or damaged valve stem seals or guide-mounted valve stem seal.
- Check valve tappet shim gap.
- Check for missing or worn valve spring seats.
- Check for plugged oil metering orifice in cylinder head oil reservoir (if equipped).

Static checks (engine off) are to be made on the engine prior to the dynamic procedure.

Valve Train Analysis — Engine Off, Camshaft Lobe Lift — OHC Engines

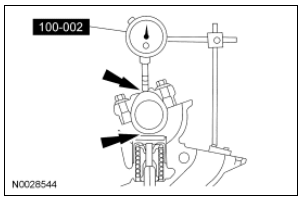
Check the lift of each camshaft lobe in consecutive order and make a note of the readings.

1. Remove the valve covers.

2. Remove the spark plugs.

3. Install the special tool so the rounded tip of indicator is on top of the camshaft lobe and on the same plane as the valve tappet.

4. Rotate the crankshaft using a breaker bar and socket attached to the crankshaft pulley retainer bolt. Rotate the crankshaft until the base circle of the camshaft lobe is reached.



5. Zero the dial indicator. Continue to rotate the crankshaft until the high-lift point of the camshaft lobe is in the fully-raised position (highest indicator reading).

6. To check the accuracy of the original indicator reading, continue to rotate crankshaft until the base circle is reached. The indicator reading should be zero. If zero reading is not obtained, repeat Steps 1 through 6.

7. Install the spark plugs.

8. Install the valve covers.

Valve Train Analysis — Engine Off, Valve Tappet

Valve tappet noise can be caused by any of the following:

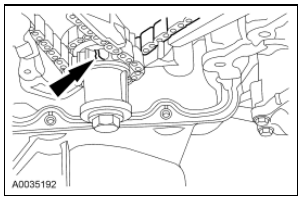
- Excessive valve tappet shim gap
- Excessive valve guide wear

Excessive collapsed valve tappet shim gap can be caused incorrect initial adjustment or wear of valve tappet shim face.

For additional information, refer to the valve train shim and gap inspection procedure in the appropriate engine section.

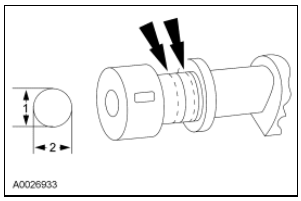
Sprockets

1. Inspect the sprockets for cracks and worn or chipped teeth.



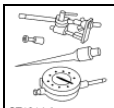
Camshaft Bearing Journal Diameter

1. Measure each camshaft journal diameter in 2 directions.
    - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Camshaft End Play — OHC Engines

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

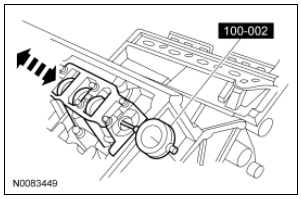
NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Using the Dial Indicator Gauge with Holding Fixture, measure the camshaft end play.

2. Position the camshaft to the rear of the cylinder head.

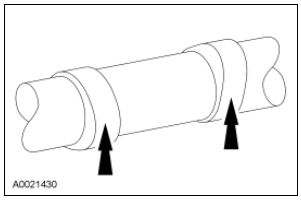
3. Zero the Dial Indicator Gauge.

4. Move the camshaft to the front of the cylinder head. Note and record the camshaft end play.
   - If camshaft end play exceeds specifications, install a new camshaft and recheck end play.
   - If camshaft end play exceeds specification after camshaft installation, install a new cylinder head.



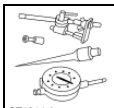
Camshaft Surface Inspection

1. Inspect camshaft lobes for pitting or damage in the contact area. Minor pitting is acceptable outside the contact area.
    - If excessive pitting or damage is present, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.

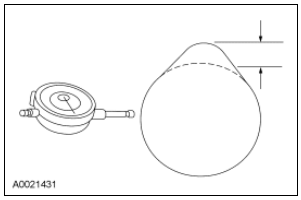


Camshaft Lobe Lift

Special Tool(s)

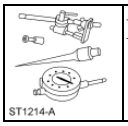
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

1. Use a Dial Indicator Gauge with Holding Fixture to measure camshaft intake/exhaust lobe lift.
   - Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading to figure the camshaft lobe lift.
   - Refer to the appropriate section in Group 303 for the procedure.



Camshaft Runout

Special Tool(s)

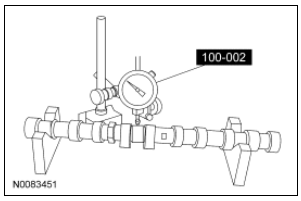
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. **NOTE:** Camshaft journals must be within specifications before checking runout.

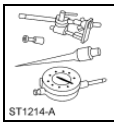
   Using the Dial Indicator Gauge with Holding Fixture, measure the camshaft runout.

   - Rotate the camshaft and subtract the lowest Dial Indicator Gauge reading from the highest Dial Indicator Gauge reading.



Crankshaft End Play

Special Tool(s)

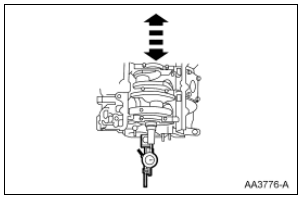
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

1. Measure the crankshaft end play. Use a Dial Indicator Gauge with Holding Fixture to measure crankshaft end play.

2. Position the crankshaft to the rear of the cylinder block.

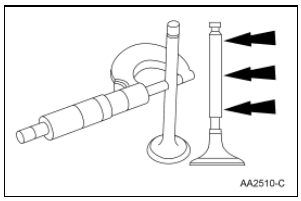
3. Zero the indicator.

4. Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.
    - If crankshaft end play exceeds specifications, install a new crankshaft thrust washer or crankshaft thrust main bearing. Refer to the appropriate section in Group 303 for the procedure.



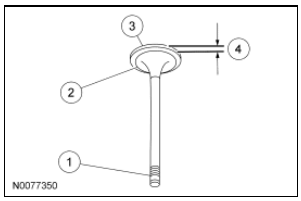
Valve Stem Diameter

1. Measure the diameter of each intake and exhaust valve stem at the points shown. Verify the diameter is within specification.
    - Refer to the appropriate section in Group 303 for the procedure.
    - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Valve Inspection

1. Inspect the following valve areas:
    1. The end of the stem for grooves or scoring.
    2. The valve face and the edge for pits, grooves or scores.
    3. The valve head for signs of burning, erosion, warpage and cracking.
    4. The valve margin for wear.

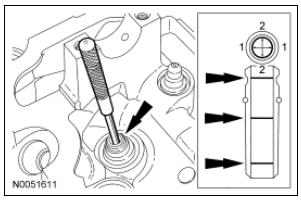


Valve Guide Inner Diameter

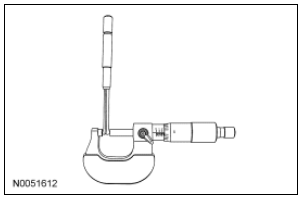
NOTE: Refer to the appropriate Section 303-01 for the specification.

1. **NOTE:** Valve guides tend to wear in an hourglass pattern. The ball gauge can be inserted into the combustion chamber side of the valve guide, if necessary.

   Use a ball gauge to determine the inside diameter of the valve guides in 2 directions at the top, middle and bottom of the valve guide.



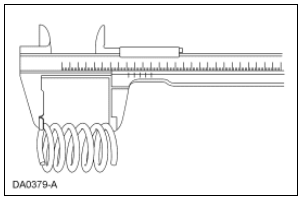
2. Measure the ball gauge with a micrometer.



3. If the valve guide is not within specifications, install a new cylinder head assembly.

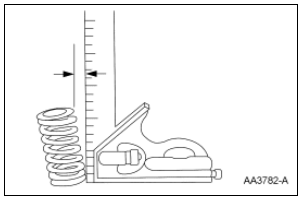
Valve Spring Free Length

1. Measure the free length of each valve spring.
    - Refer to the appropriate section in Group 303 for the procedure.
    - If out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Valve Spring Squareness

1. Measure the out-of-square on each valve spring.
    - Turn the valve spring and observe the space between the top of the valve spring and the square. Install a new valve spring if out of square. Refer to the appropriate section in Group 303 for the procedure.



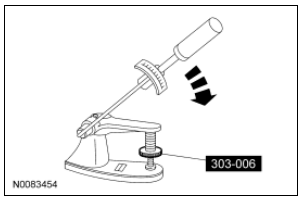
Valve Spring Strength

Special Tool(s)

ST1278-A	Pressure Gauge, Valve/Clutch Spring 303-006 (TOOL-6513-DD) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Use the Valve/Clutch Spring Pressure Gauge to check the valve spring for correct strength at the specified valve spring length.



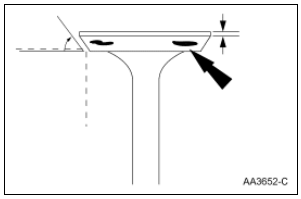
Valve Seat Inspection

Valve and Seat Refacing Measurements

NOTE: Refer to the appropriate Section 303-01 for the specification.

NOTE: After grinding valves or valve seats, check valve clearance.

1. Check the valve head and seat.
   - Check valve angles.
   - Check margin width.
   - Be sure margin width is within specification.



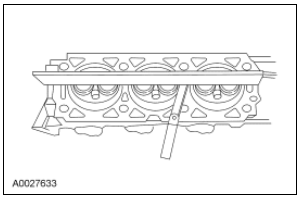
2. Inspect for abnormalities on the valve face and seat. Install a new cylinder head assembly if abnormalities are found.

Cylinder Head Distortion

Special Tool(s)

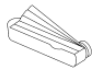
ST1246-A	Straight Edge 303-D039 (D83L-4201-A) or equivalent

1. Use a straight edge and a feeler gauge to inspect the cylinder head for flatness. If the cylinder head is distorted, install a new cylinder head.



Cylinder Block Distortion

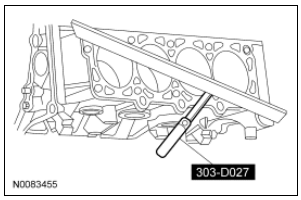
Special Tool(s)

 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

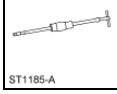
1. **NOTE:** Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

   Use a Straightedge and a Feeler Gauge Set to inspect the cylinder block for flatness.



Core Plug Replacement

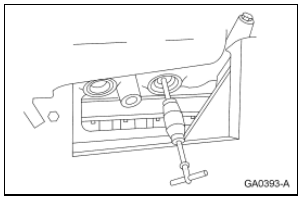
Special Tool(s)

 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Threadlock 262 TA-26	WSK-M2G351-A6

1. Use a slide hammer or tools suitable to remove the cylinder block core plug.


GA0393-A

2. Inspect the cylinder block plug bore for any damage that would interfere with the correct sealing of the plug. If the cylinder block plug bore is damaged, bore for the next oversize plug.

3. **NOTE:** Oversize plugs are identified by the OS stamped in the flat located on the cup side of the plug.

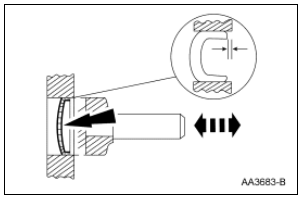
   Coat the cylinder block core plug and bore lightly with Threadlock 262 and install the cylinder block core plug.

Cup-Type

1. ⚠ **CAUTION: Use care during this procedure so as not to disturb or distort the cup sealing surface.**

   ⚠ **CAUTION: When installed, the flanged edge must be below the chamfered edge of the bore to effectively seal the bore.**

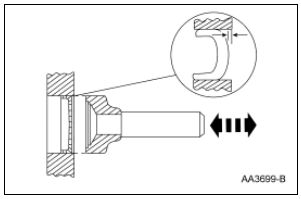
   Use a tool suitable to seat the cup-type cylinder block core plug.


AA3683-B

Expansion-Type

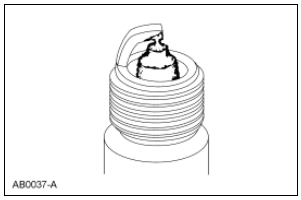
1. ⚠ **CAUTION: Do not contact the crown when installing an expansion-type cylinder block core plug. This could expand the plug before seating and result in leakage.**

   Use tool suitable to seat the expansion-type cylinder block core plug.

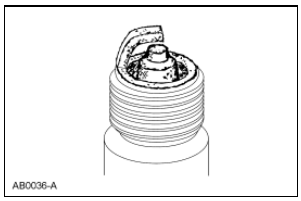


Spark Plug Inspection

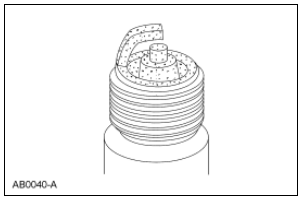
1. Inspect the spark plug for a bridged gap.
    - Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.
    - Install a new spark plug.



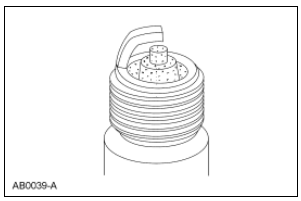
2. Check for oil fouling.
    - Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.
    - Correct the oil leak concern.
    - Install a new spark plug.



3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
    - Install new spark plugs.



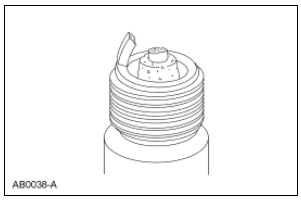
4. Inspect for normal burning.
    - Check for light tan or gray deposits on the firing tip.



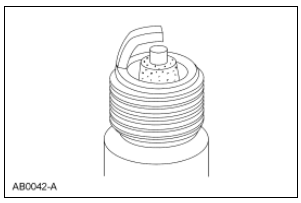
5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a heli-coil insert in place of the spark plug

threads.

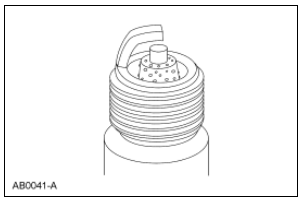
- Install a new spark plug.



6. Inspect for overheating, identified by white or light gray spots and with a bluish-burnt appearance of electrodes. This is caused by engine overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing.
   - Install a new spark plug.



7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.
   - Install new spark plugs.



Exhaust Manifold Cleaning and Inspection

Special Tool(s)

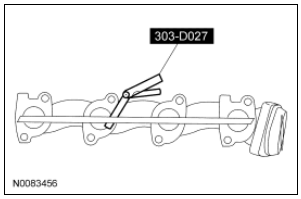
ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

1. Clean the exhaust manifold using a suitable solvent. Use a plastic scraping tool to clean the gasket sealing surfaces.

2. **NOTE:** New exhaust manifold gaskets, studs, nuts and/or bolts must be installed when an exhaust manifold is serviced.

   NOTE: Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

   Using the Straightedge and a Feeler Gauge Set, check the exhaust manifold sealing surface for warpage. If the warpage is greater than 0.76 mm (0.0299 in), install a new exhaust manifold.



General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Silicone Gasket Remover ZC-30	—
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Engine	
Displacement	3.9L (238 CID)
Number of cylinders	8
Bore	86 mm (3.386 in)
Stroke	85 mm (3.346 in)
Firing order	1-5-4-2-6-3-7-8
Oil pressure minimum at 400 rpm (engine at normal operating temperature)	413-482 kPa (61-73 psi)
Engine oil capacity (with filter change)	6.5 liters (6.9 quarts)
Cylinder Head and Valve Train	
Cylinder head gasket surface flatness	0.08 mm (0.003 in) total
Combustion chamber volume	48.73 ± 2.068-2.018 cc
Valve stem diameter — intake	4.9763-4.978 mm (0.196-0.197 in)
Valve stem diameter — exhaust	4.955-4.970 mm (0.195-0.196 in)
Valve stem-to-guide clearance — intake	0.022 mm (0.001 in)
Valve stem-to-guide clearance — exhaust	0.030 mm (0.001 in)
Valve head diameter — intake	43.89 mm (1.728 in)
Valve head diameter — exhaust	30.9 mm (1.216 in)
Valve face runout	0.04 mm (0.002 in)
Valve face angle	45 degrees
Valve seat width — intake	1 mm (0.0393 in)
Valve seat width — exhaust	2 mm (0.0787 in)
Valve seat angle — intake	14 degrees
Valve seat angle — exhaust	13 degrees
Camshaft	
Lobe lift — intake	9 mm (0.354 in)
Lobe lift — exhaust	8.4 mm (0.330 in)
End play	0.100-0.125 mm (0.0003-0.007 in)

Cylinder Block	
Cylinder head gasket surfaces flatness	0.025 mm (0.001 in) in any 25 mm (1 in) X 25 mm (1 in) area, 0.05 mm (0.002 in) in any 150 mm (6 in) X 150 mm (6 in) area, 0.1 mm (0.004 in) overall
Accessory Drive Belt	
Drive belt	6 ribs

Torque Specifications

Description	Nm	lb-ft	lb-in
Intake manifold bolts [a]	—	—	—
Fuel rail bolts	10	—	89
Radio interference capacitor nuts	10	—	89
Wiring harness retainer nuts	10	—	89
Engine appearance cover bracket nuts	6	—	53
Cross-vehicle brace bolts	20	15	—
Valve cover bolts [a]	—	—	—
Fuel hose bracket bolt	11	8	—
Power steering pump reservoir upper bolt	6	—	53
Power steering pump reservoir lower bolt	12	9	—
Crankshaft pulley bolt [a]	—	—	—
Flexplate bolts [a]	—	—	—
Engine front cover bolts [a]	—	—	—
Power steering pump bracket bolts	25	18	—
Power steering pump bolts	25	18	—
Lower radiator hose bracket nut	10	—	89
Secondary timing chain tensioner bolts	11	8	—
Timing chain guide bolts	11	8	—
Timing chain tensioner arm bolts	11	8	—
Exhaust camshaft sprocket bolts [a]	—	—	—
Variable cam timing (VCT) unit bolts [a]	—	—	—
Primary timing chain tensioner bolts	11	8	—
VCT bush carrier bolts	20	15	—
VCT bush carrier nuts	10	—	89
Crankshaft position (CKP) sensor bolt	10	—	89
Camshaft bearing cap bolts [a]	—	—	—
Spark plugs	27	20	—
Oil pan drain plug	23	17	—
Oil pan bolts [a]	—	—	—
Oil pump bolts [a]	—	—	—
Oil pump screen and pickup tube bolts	12	9	—

Oil cooler assembly	60	44	—
Oil filter [b]	—	—	—
Oil level indicator tube nut	6	—	53
Oil filter adapter bolts [a]	—	—	—
Exhaust manifold bolts [a]	—	—	—
Exhaust manifold heat shield bolts	3	—	27
Exhaust manifold heat shield stud bolts	50	37	—
Exhaust gas recirculation (EGR) tube flange nuts	20	15	—
Engine mount-to-frame nuts (N621942-S441)	55	41	—
Engine mount-to-bracket nuts	50	37	—
Engine mount bracket-to-cylinder block bolts	46	34	—
Engine mount bracket-to-cylinder block stud bolts	46	34	—
Transmission cooling tube bracket nut	10	—	89
Power steering tube bracket nut	10	—	89
Cylinder block drain plug	50	37	—
Cylinder head bolts [a]	—	—	—
Throttle body adapter bolts	10	—	89
EGR system module bolts	25	18	—
EGR system module tube fitting nut	40	30	—
Ignition coil bolts	5	—	44
Ignition coil cover bolts	10	—	89
Accessory drive belt idler pulley bolt	25	18	—
Accessory drive belt tensioner bolt	25	18	—
Engine-to-transmission bolts	47	35	—
Transmission cooler tube nuts	35	26	—
A/C compressor bolts	25	18	—
Crossmember bolts (W708091-S439)	90	66	—
Crossmember I-brace bolts	30	22	—
Transmission support bolts	55	41	—
Torque converter nuts (N800750-S437)	48	35	—
Starter motor wiring (large nut)	12	9	—
Starter motor wiring (small nut)	6	—	53
Starter motor ground cable	25	18	—
Steering coupling bolt	35	26	—
Steering shaft bolt	30	22	—
Shift cable bracket bolts	10	—	89
Lower strut mount bolts	175	129	—
Upper ball joint nuts	90	66	—
Stabilizer bar link nuts	55	41	—
Front brake caliper bolts	35	26	—
A/C high pressure hose	8	—	71
Driveshaft bolts	81	60	—
Bulkhead electrical connectors	6	—	53
Ground strap bolt	10	—	89

Radiator support bracket bolts	10	—	89
Knock sensor (KS) bolts	20	15	—
Oil sump bolts [a]	—	—	—
Coolant pump bolts [a]	—	—	—
Starter motor bolts [a]	—	—	—
Coolant inlet housing bolts	10	—	89
Generator bracket bolts	42	31	—
Generator bolts and nut	40	30	—
Generator electrical connector nut	8	—	71
Coolant pump pulley bolts	10	—	89
Camshaft position (CMP) sensor bolt	10	—	89
Cylinder head temperature (CHT) sensor	22	16	—

[a] Refer to procedure for staged torque.
[b] Install oil filter until seal makes contact. Tighten an additional 270 degrees.

Engine

⚠ WARNING: Do not operate the engine with the hood open until the fan blade has been first examined for possible cracks and separation.

The 3.9L (238 CID) is a V-8 engine with the following features:

- Dual overhead camshafts
- Four valves per cylinder
- Sequential multiport fuel injection (SFI)
- Aluminum cylinder heads
- Cast aluminum, 90-degree V-cylinder block
- Individually chain-driven camshafts with a hydraulic timing chain tensioner on each timing chain
- Electronic ignition system with 8 ignition coils

Identification

For quick identification refer to the safety certification decal.

- The decal is located on the LH front door lock face panel.
- Find the engine code (letter or number) on the decal, then refer to the Engine Identification Chart to determine engine type and size. For additional information, refer to Section 100-01 .
- The symbol code on the identification tag identifies each engine for determining parts usage; for example, engine displacement in liters or cubic inch displacement and model year.

Engine Code Information

The engine code information label is located on the valve cover. The label contains, among other information:

- the engine calibration number.
- the engine build date.
- the engine plant code.
- the engine code.

Emission Calibration Label

NOTE: The engine codes and the calibration numbers must be used when making inquiries or ordering parts.

The emission calibration number label is located on the LH side door or LH door post pillar. It identifies:

- the engine calibration number.
- the engine code number.
- the revision level.

These numbers are used to determine if parts are unique to specific engines.

Exhaust Emission Control System

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Induction System

The air/fuel mixture is provided by the multiport fuel injection (MFI) system. Refer to Section 303-04 for additional information.

Fuel is:

- supplied from the fuel tank by the fuel pump.
- regulated by the fuel pressure sensor.
- delivered to the injector supply manifold.

A dual damper has been added to reduce pressure fluctuations caused by the fuel injectors.

Crankshaft

The crankshaft is supported on the bottom of the cylinder block by 5 steel-backed, over-plated, aluminum crankshaft main bearings.

To provide smooth engine operation, the piston crank pins are positioned to provide a power impulse every 90 degrees of crankshaft rotation. The spacing provides smooth and quiet operation.

Camshafts

The camshafts:

- are arranged in pairs, one each (intake and exhaust) on each cylinder head.
- are synchronized through a secondary timing chain.
- depress the direct acting mechanical tappets to actuate the valves.

Valve Train

The valves are actuated by a direct acting mechanical bucket and shim. The direct acting mechanical tappets and shims:

- provide lash adjustment through a shim selected by thickness.
- ride on the camshaft lobes.

Crankcase Ventilation System

The engine is equipped with a closed-type crankcase ventilation system which recycles the crankcase vapors to the throttle body.

Engine Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the:

- crankshaft main bearings.
- crankshaft thrust main bearing.
- connecting rod bearings.
- oil galleys.

Oil Pump

The rotary spur oil pump develops the oil pressure.

- The oil pump is bolted to the front of the cylinder block.

- The oil pump is rotated by the crankshaft.
- A full flow oil filter is externally mounted on the upper sump.

If the filter element becomes blocked, a spring-loaded bypass valve opens to allow uninterrupted flow of oil to the engine.

Engine Cooling System

The engine is liquid-cooled:

- by a centrifugal coolant pump driven by the drive belt.
- a thermostat is used to restrict coolant flow until the engine reaches normal operating temperature.

Drive Belt System

Accessories mounted on the front of the engine are belt-driven by the crankshaft and an automatically tensioned serpentine drive belt is routed over the following components:

- Coolant pump
- A/C compressor
- Generator
- Drive belt tensioner
- Drive belt idler pulley
- Crankshaft pulley
- Power steering pump

Engine

Refer to Section 303-00 for basic mechanical concerns.

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for driveability concerns.

Valve Clearance Check

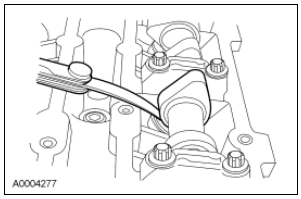
1. Remove the valve covers. For additional information, refer to Valve Cover — LH or Valve Cover — RH in this section.

2. Remove the spark plugs.

3. **NOTE:** The engine will have to be rotated with the crankshaft pulley bolt to bring each valve to base circle.

   NOTE: The valve clearance must be measured with the camshaft at base circle.

   Measure and record all valve clearances.



4. If the valve clearances are out of specification, refer to Valve Clearance Adjustment in this section.

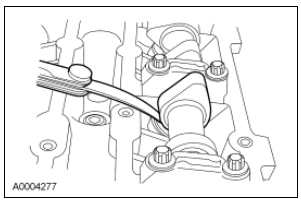
5. To assemble, reverse the inspection procedure.

Valve Clearance Adjustment

1. Remove the timing chains. For additional information, refer to Timing Drive Components in this section.

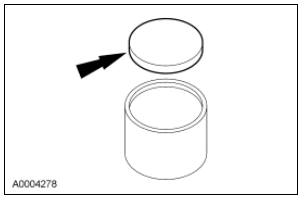
2. **NOTE:** Measure each valve clearance at base circle before removing the camshafts. The shims are not repairable with the camshafts in place. Failure to measure all clearances prior to removing the camshafts will cause unnecessary repetition of the procedure.

   Use a feeler gauge to measure each valve clearance and record its location.



3. Remove the camshafts. For additional information, refer to Valve Train Components — Exploded View and Camshafts in this section.

4. Remove the shims.



5. **NOTE:** The shims are marked for thickness; example: 2.22 mm = 222 on shim.

   NOTE: The corrected shims allow the following valve clearances.

   - Intake valve clearance: 0.18-0.22 mm (0.00709-0.00866 in)
   - Exhaust valve clearance: 0.33-0.38 mm (0.0128-0.0148 in)

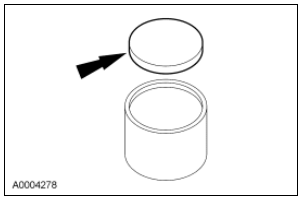
   NOTE: A midrange clearance is the most desirable:

   - Intake: 0.20 mm (0.00787 in)
   - Exhaust: 0.35 mm (0.014 in)

   NOTE: Select shims using this formula: required shim thickness = measured clearance plus the base shim thickness minus most desirable clearance.

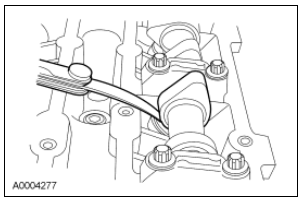
   Select shims and mark the installation location.

6. Install new shims.



7. Install the camshafts. For additional information, refer to Valve Train Components — Exploded View and Camshafts in this section.

8. Measure the new valve clearances.

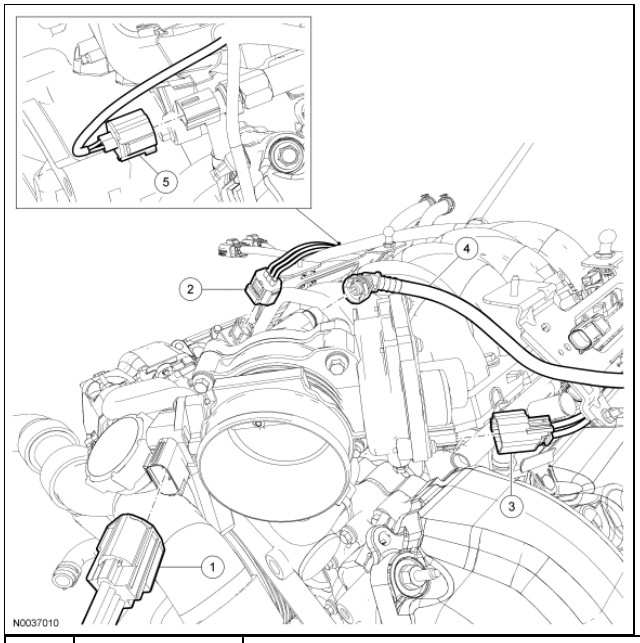


9. Install the timing chains. For additional information, refer to Timing Drive Components in this section.

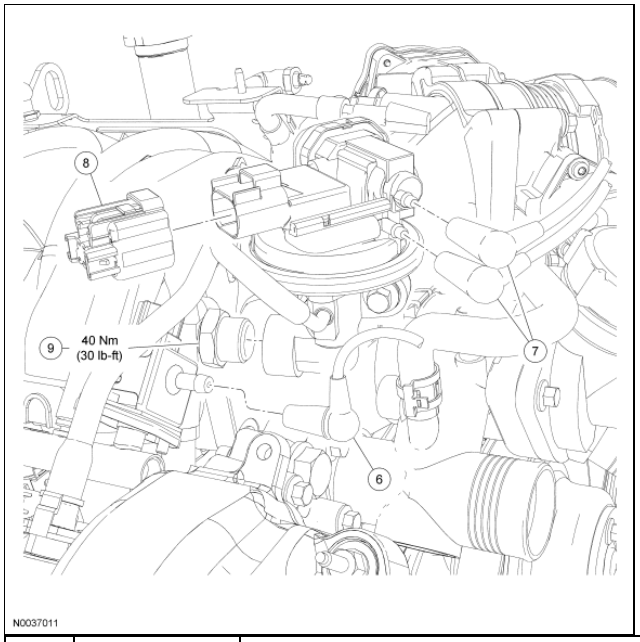
Intake Manifold

Material

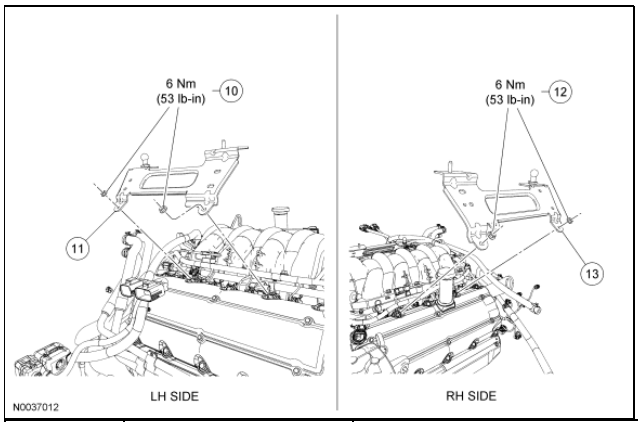
Item	Specification
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A



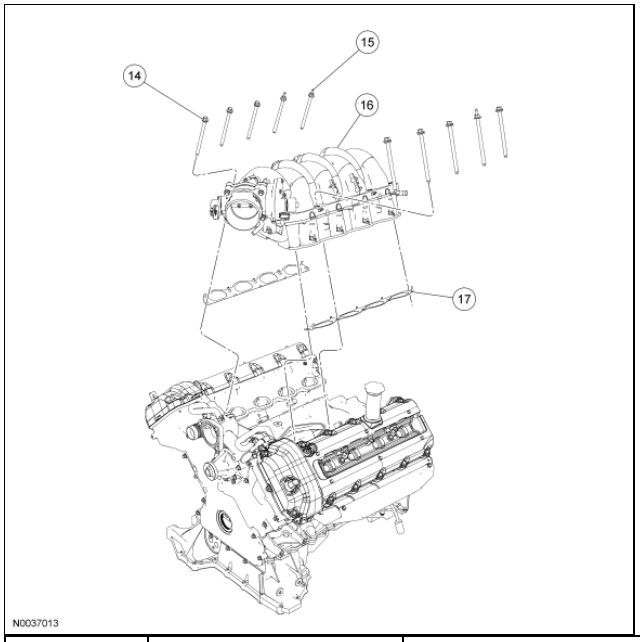
Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	14A464	Fuel pressure sensor electrical connector (part of 12B637)
3	14A464	Throttle body electrical connector (part of 12B637)
4	9D289	Evaporative emissions (EVAP) hose
5	14A464	Fuel rail temperature sensor electrical connector (part of 12B637)



Item	Part Number	Description
6	9E499	Fuel pressure sensor vacuum connector
7	9E498	Exhaust gas recirculation (EGR) system module vacuum connectors
8	14A464	EGR system module electrical connector (part of 12B637)
9	9D477	EGR system module-to-exhaust manifold tube fitting



Item	Part Number	Description
10	W520411	RH engine appearance cover bracket nuts (2 required)
11	129723	RH engine appearance cover bracket
12	W520411	LH engine appearance cover bracket nuts (2 required)
13	129723	LH engine appearance cover bracket



Item	Part Number	Description
14	W704916	Intake manifold bolt (7 required)
15	W708238	Intake manifold stud (3 required)
16	9424	Intake manifold
17	9439	Intake manifold gasket (2 required)

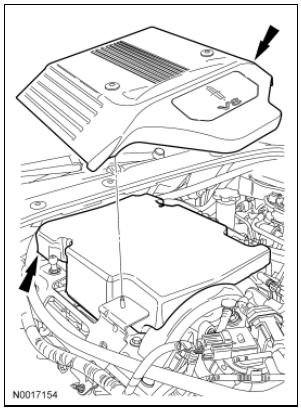
Removal

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury. Failure to follow these instructions may result in personal injury.

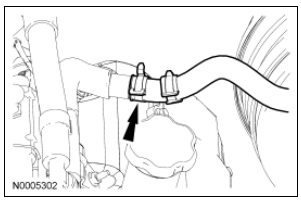
⚠ WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard. Failure to follow these instructions may result in personal injury.

1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Drain the cooling system. For additional information, refer to Section 303-03 .
3. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
4. ***NOTICE:*** **The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

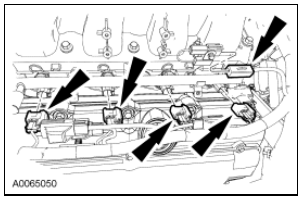
   Remove the engine appearance cover and the noise suppressor (if detached).



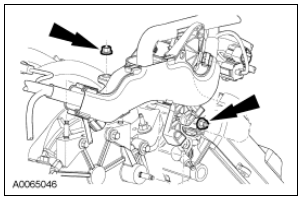
5. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .
6. Remove the cowl panel grille. For additional information, refer to Section 501-02 .
7. Disconnect the fuel supply tube spring lock coupling from the fuel rail. For additional information, refer to Section 310-00 .
8. Remove the 6 bolts and the cross-vehicle brace.
9. Disconnect the throttle position (TP) sensor electrical connector.
10. Disconnect the fuel pressure sensor electrical connector and vacuum hose.
11. Disconnect the throttle body electrical connector.
12. Disconnect the evaporative emissions (EVAP) hose from the intake manifold.
13. Disconnect the fuel rail temperature sensor electrical connector.
14. Disconnect the exhaust gas recirculation (EGR) system module electrical connector and the vacuum harness from the EGR system module.
15. Disconnect the EGR system module-to-exhaust manifold tube from the EGR system module.
16. Remove the crankcase ventilation tube.
17. Disconnect the vacuum supply tube.



18. Detach the vacuum harness retainers from the LH engine appearance cover bracket.
19. Detach the engine wiring harness from the engine appearance cover brackets.
20. Remove the 4 nuts and the 2 engine appearance cover brackets.
21. Disconnect the 8 fuel injectors and the radio interference ignition capacitor electrical connectors.



22. Remove the 2 nuts and the engine wiring harness retainer.

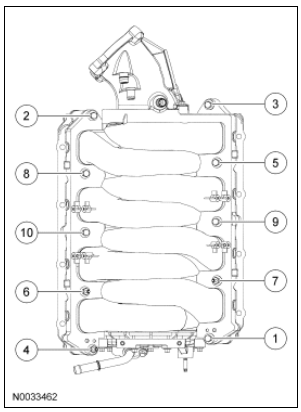


23. Remove the nut and the radio interference ignition capacitor.

24. Disconnect the 2 throttle body coolant tubes.

25. **NOTE:** The throttle body and adapter are shown removed for clarity. It is not necessary to remove the throttle body and adapter to remove the intake manifold.

    Remove the 7 bolts and 3 studs in the sequence shown.



26. Remove the intake manifold and discard the gaskets.

Installation

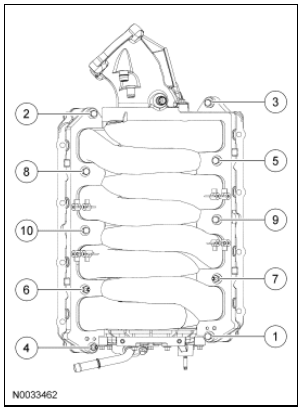
1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to clean the surfaces.**

   Clean the gasket sealing surfaces.

2. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

   Install new gaskets, the intake manifold, the 7 bolts and the 3 studs in the sequence shown.

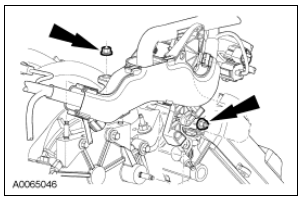
   - Tighten to 20 Nm (15 lb-ft).



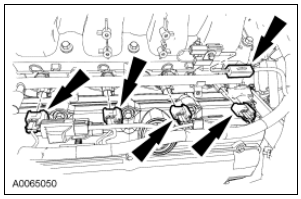
3. Connect the 2 throttle body coolant tubes.

4. Install the radio interference ignition capacitors and nuts.
   - Tighten to 10 Nm (89 lb-in).

5. Install the engine wiring harness retainer and the 2 nuts.
   - Tighten to 10 Nm (89 lb-in).



6. Connect the 8 fuel injectors and the radio interference ignition capacitor electrical connectors.

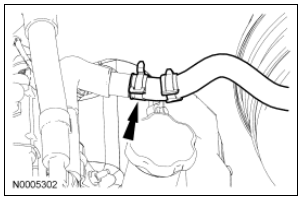


7. Install the 2 engine appearance cover brackets and the 4 nuts.
   - Tighten to 6 Nm (53 lb-in).

8. Attach the engine wiring harness to the engine appearance cover brackets.

9. Attach the vacuum harness retainers to the LH engine appearance cover bracket.

10. Connect the vacuum supply tube.



11. Install the crankcase ventilation tube.

12. Connect the EGR system module-to-exhaust manifold tube to the EGR system module.
   - Tighten to 40 Nm (30 lb-ft).

13. Connect the EGR system module electrical connector and the vacuum harness to the EGR system module.

14. Connect the fuel rail temperature sensor electrical connector.

15. Connect the EVAP hose to the intake manifold.

16. Connect the throttle body electrical connector.

17. Connect the fuel pressure sensor electrical connector and vacuum hose.

18. Connect the TP sensor electrical connector.

19. Install the 6 bolts and the cross-vehicle brace.
    - Tighten to 20 Nm (15 lb-ft).

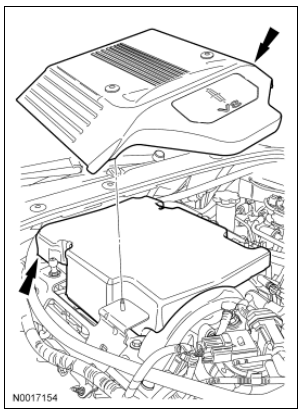
20. Connect the fuel supply tube spring lock coupling to the fuel rail. For additional information, refer to Section 310-00 .

21. Install the cowl panel grille. For additional information, refer to Section 501-02 .

22. Install the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

23. ***NOTICE:*** **The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

    Install the noise suppressor (if detached) and the engine appearance cover.



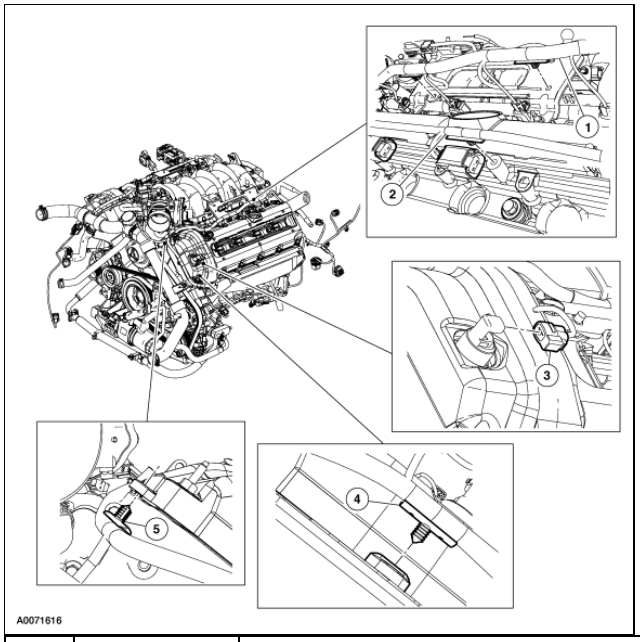
24. Connect the battery ground cable. For additional information, refer to Section 414-01 .

25. Fill and bleed the cooling system. For additional information, refer to Section 303-03 .

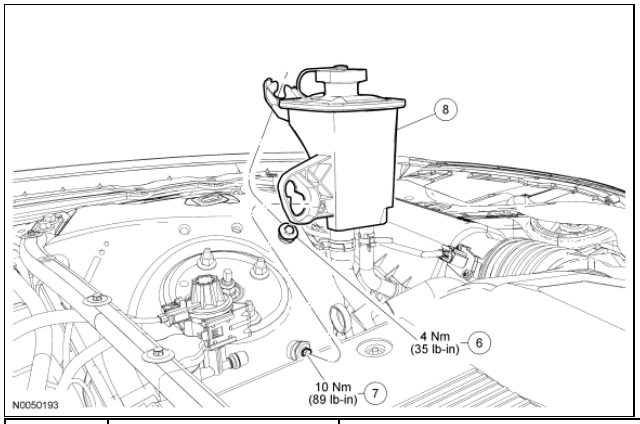
Valve Cover — LH

Material

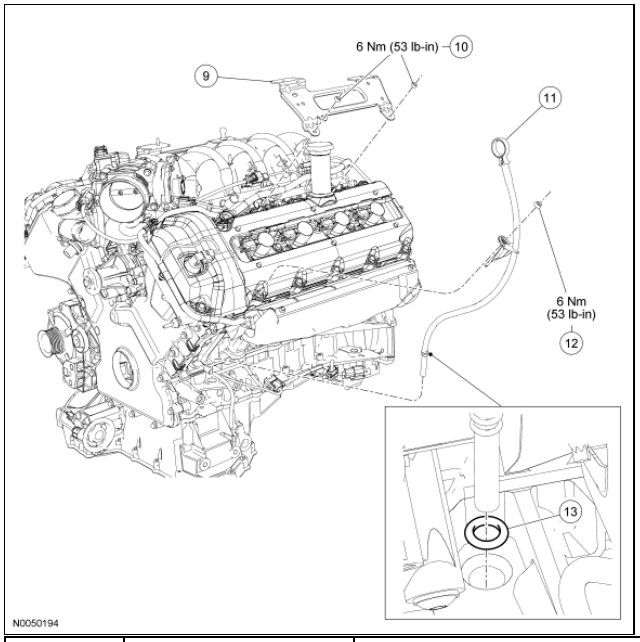
Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	—
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



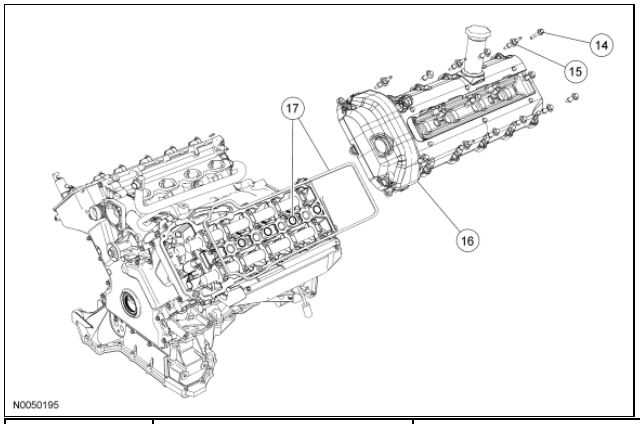
Item	Part Number	Description
1	6A005	Engine wiring harness retainer (part of 12B637)
2	6A005	Engine wiring harness retainer (part of 12B637)
3	14A464	Variable cam timing (VCT) sensor electrical connector (part of 12B637)
4	6A005	Engine wiring harness retainer (part of 12B637)
5	6A005	Engine wiring harness retainer (part of 12B637)



Item	Part Number	Description
6	N803882	Upper power steering reservoir isolator bolt
7	W705012-S306	Lower power steering reservoir isolator bolt
8	3E764	Power steering fluid reservoir



Item	Part Number	Description
9	129723	LH engine appearance cover bracket
10	W520411	LH engine appearance cover bracket nuts (2 required)
11	W520411	Oil level indicator and tube
12	6754	Oil level indicator nut
13	6B033	O-ring seal



Item	Part Number	Description
14	6050	LH valve cover bolt (10 required)
15	6083	LH valve cover stud (4 required)
16	6582	LH valve cover
17	6083	LH valve cover gaskets

Removal

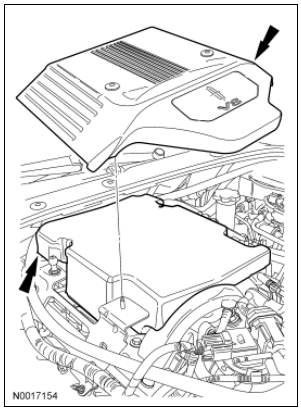
⚠ CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.

1. Release the fuel system pressure. For additional information, refer to Section 310-00 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. **⚠ CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Remove the engine appearance cover and the noise suppressor (if detached).



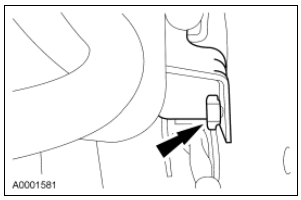
4. Remove the air cleaner. For additional information, refer to Section 303-12 .

5. Remove the LH ignition coil-on-plugs. For additional information, refer to Section 303-07 .

6. Disconnect the fuel tube spring lock coupling at the fuel rail. For additional information, refer to Section 310-00 .

7. Disconnect the variable cam timing (VCT) solenoid electrical connector.

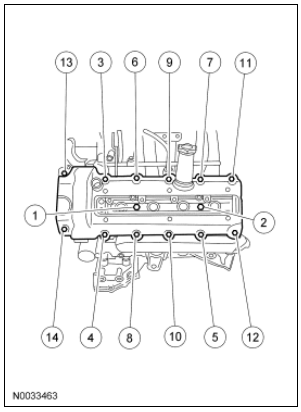
8. Detach the vacuum harness retainers from the LH engine appearance cover bracket.
9. Detach the 4 wiring harness retainers and position the wiring harness aside.
10. Remove the 2 nuts and the LH engine appearance cover bracket.
11. Disconnect the crankcase ventilation tube from the valve cover.
12. Disconnect the evaporative emissions (EVAP) hose from the intake manifold.
13. Loosen the upper power steering fluid reservoir isolator bolt.
14. Loosen the lower power steering fluid reservoir isolator bolt.
15. Lift the power steering fluid reservoir upward, off the isolators, and position aside.
16. Remove the bolt and the oil level indicator tube.
    - Discard the O-ring seal.
17. Remove the fuel hose bracket bolt from the LH shock tower.



18. Loosen the bolts and position the power steering pump reservoir aside.
19. **NOTE:** The valve cover bolts are not to be removed from the valve cover.

    Loosen the bolts in the sequence shown.

    - Remove the LH valve cover.
    - Discard the gaskets.

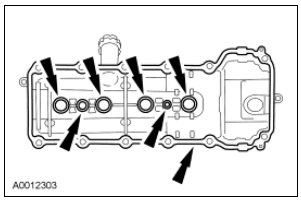


Installation

1. ⚠ **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**

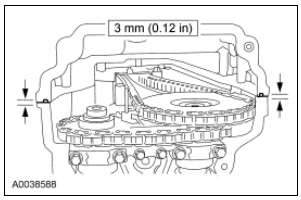
Clean the valve cover, cylinder head and front cover sealing surfaces with silicone gasket remover and metal surface prep.

2. Install new gaskets.

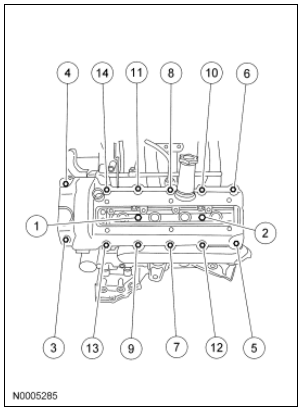


3. **NOTE:** The valve cover must be installed and the bolts and stud bolts tightened within 4 minutes of sealant application.

   Apply a 3 mm (0.12 in) dot of silicone gasket sealant to the front cover-to-cylinder head joints.

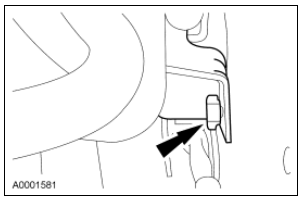


4. Install the LH valve cover.
   - Tighten the bolts in the sequence shown to 10 Nm (89 lb-in).



5. Install the power steering pump reservoir.
   - Tighten upper bolt to 6 Nm (53 lb-in).
   - Tighten lower bolt to 12 Nm (9 lb-ft).

6. Install the fuel hose bracket bolt to the LH shock tower.
   - Tighten to 11 Nm (8 lb-ft).



7. ⚠ **CAUTION: Failure to lubricate the O-ring seal and the oil level indicator tube-to-engine block mating surface with clean engine oil can result in engine oil leaks.**

⚠ CAUTION: Make sure the O-ring seal remains in position and does not roll up the indicator tube during installation.

Install a new O-ring seal, oil level indicator tube and nut.

- Lubricate the new O-ring seal and engine mating surface with clean engine oil.
- Tighten to 6 Nm (53 lb-in).

8. Position the power steering fluid reservoir on the isolator bolts.

9. Tighten the lower power steering fluid reservoir isolator bolt.
   - Tighten to 10 Nm (89 lb-in).

10. Tighten the upper power steering fluid reservoir isolator bolt.
    - Tighten to 4 Nm (35 lb-in).

11. Connect the EVAP hose to the intake manifold.

12. Connect the crankcase ventilation tube to the valve cover.

13. Install the LH engine appearance cover bracket and the 2 nuts.
    - Tighten to 6 Nm (53 lb-in).

14. Position the wiring harness and attach the 4 wiring harness retainers.

15. Attach the vacuum harness retainers to the LH engine appearance cover bracket.

16. Connect the VCT solenoid electrical connector.

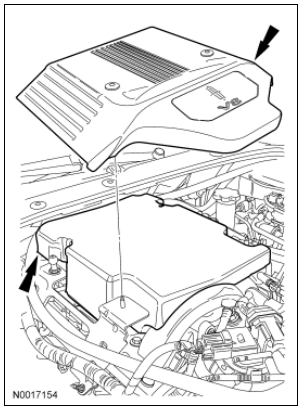
17. Install the LH ignition coil-on-plugs. For additional information, refer to Section 303-07 .

18. Connect the fuel tube spring lock coupling. For additional information, refer to Section 310-00 .

19. Install the air cleaner. For additional information, refer to Section 303-12 .

20. **⚠ CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

    Install the noise suppressor (if detached) and the engine appearance cover.

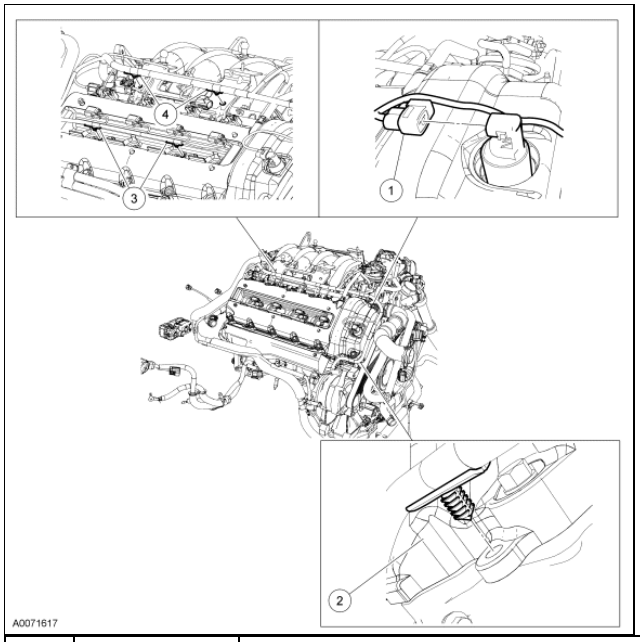


21. Connect the battery ground cable. For additional information, refer to Section 414-01 .

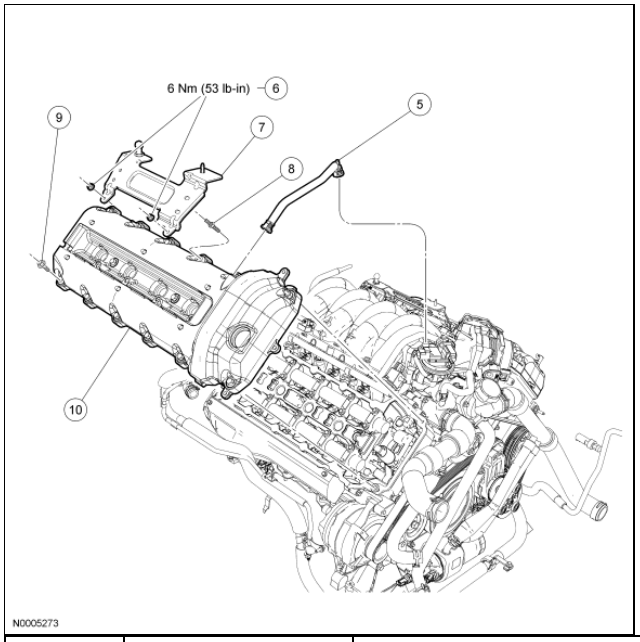
Valve Cover — RH

Material

Item	Specification
Silicone Gasket Remover ZC-30	—
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



Item	Part Number	Description
1	14A464	Variable cam timing (VCT) sensor electrical connector (part of 12B637)
2	6A005	Engine wiring harness retainer (part of 12B637)
3	6A005	Engine wiring harness retainer (part of 12B637)
4	6A005	Engine wiring harness retainer (part of 12B637)



Item	Part Number	Description
5	6C342	Crankcase ventilation tube
6	W520411	RH engine appearance cover bracket nuts (2 required)
7	129723	RH engine appearance cover bracket
8	6083	RH valve cover stud (3 required)
9	6050	RH valve cover bolt (11 required)
10	6582	RH valve cover

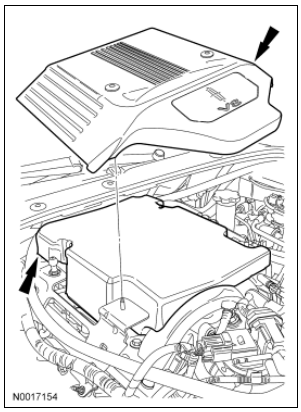
Removal

⚠ CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. **⚠ CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Remove the engine appearance cover and the noise suppressor (if detached).



3. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

4. Remove the RH ignition coil-on-plugs. For additional information, refer to Section 303-07 .

5. Disconnect the VCT solenoid electrical connector.

6. Detach the 3 wiring harness retainers and position the wiring harness aside.

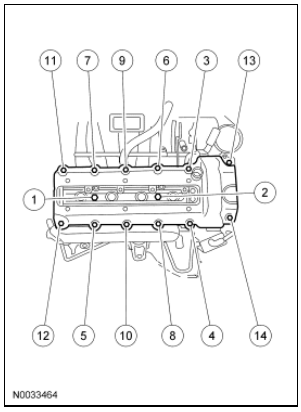
7. Remove the crankcase ventilation tube.

8. Remove the 2 nuts and the RH engine appearance cover bracket.

9. **NOTE:** The valve cover bolts are not to be removed from the valve cover.

   Loosen the bolts in the sequence shown.

   - Remove the RH valve cover.
   - Discard the gaskets.

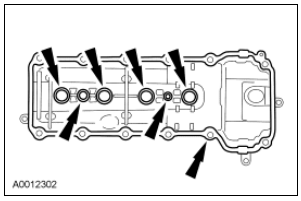


Installation

1. ⚠ **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**

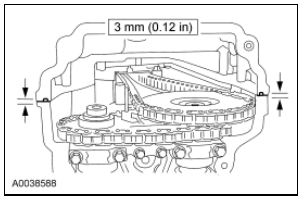
   Clean the valve cover, cylinder head and front cover sealing surfaces with silicone gasket remover and metal surface prep.

2. Install new gaskets.

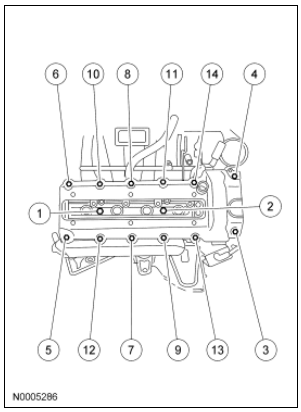


3. **NOTE:** The valve cover must be installed and the bolts and stud bolts tightened within 4 minutes of sealant application.

   Apply a 3 mm (0.12 in) dot of silicone gasket sealant to the front cover-to-cylinder head joints.



4. Install the RH valve cover.
    - Tighten the bolts in the sequence shown to 10 Nm (89 lb-in).



5. Install the RH engine appearance cover bracket and the 2 nuts.
    - Tighten to 6 Nm (53 lb-in).

6. Install the crankcase ventilation tube.

7. Position the wiring harness and attach the 3 wiring harness retainers.

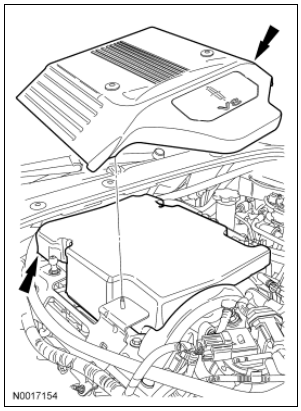
8. Connect the VCT solenoid electrical connector.

9. Install the RH ignition coil-on-plugs. For additional information, refer to Section 303-07 .

10. Install the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

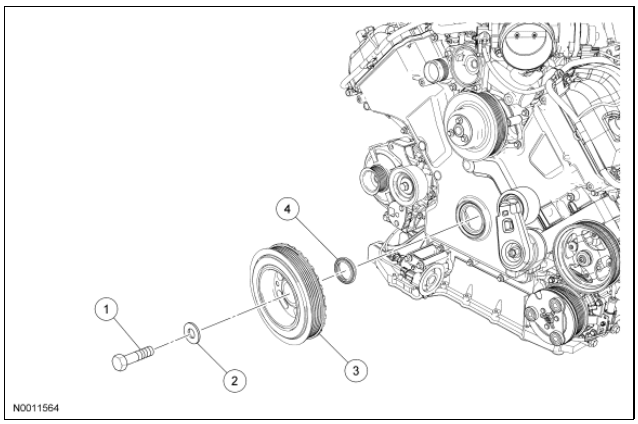
11. ⚠ **CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

    Install the noise suppressor (if detached) and the engine appearance cover.



12. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Lower End Components — Exploded View, Crankshaft Pulley and Crankshaft Front Seal



Item	Part Number	Description
1	W705542	Crankshaft pulley bolt
2	W704965	Crankshaft pulley bolt washer
3	6316	Crankshaft pulley
4	6278	Crankshaft front seal

1. For additional information, refer to the procedures in this section.

Crankshaft Pulley

Special Tool(s)

ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
ST1438-A	Strap Wrench 303-D055

Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Removal

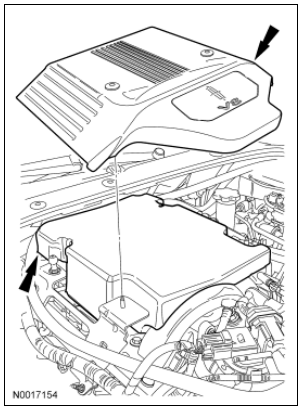
⚠ CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. **⚠ CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Remove the engine appearance cover and the noise suppressor (if detached).


N0017154

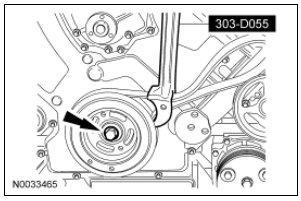
4. Remove the cooling fan assembly. For additional information, refer to Section 303-03 .

5. Remove the accessory drive belt. For additional information, refer to Section 303-05 .

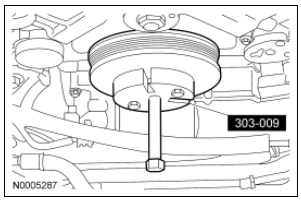
6. Remove the oil cooler. For additional information, refer to Oil Cooler in this section.

7. **NOTE:** Hold the crankshaft pulley with the special tool while removing the bolt and washer.

   Remove and discard the bolt and washer.



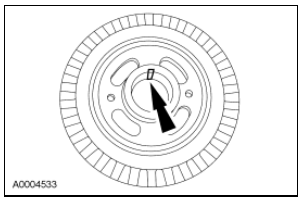
8. Using the special tool, remove the crankshaft damper.



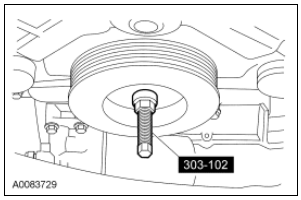
Installation

1. **NOTE:** If the crankshaft pulley is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

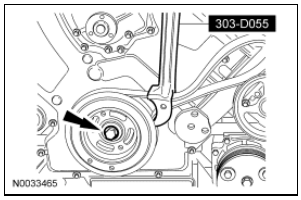
   Apply a bead of silicone gasket and sealant to the keyway.



2. Using the special tool, install the crankshaft pulley.



3. Install a new bolt and tighten in 4 stages.
   - Stage 1: Tighten to 80 Nm (59 lb-ft).
   - Stage 2: Loosen 2 complete turns.
   - Stage 3: Tighten to 50 Nm (37 lb-ft).
   - Stage 4: Tighten an additional 90 degrees.



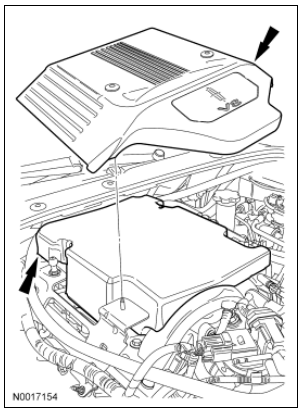
4. Install the oil cooler. For additional information, refer to Oil Cooler in this section.

5. Install the accessory drive belt. For additional information, refer to Section 303-05 .

6. Install the cooling fan assembly. For additional information, refer to Section 303-03 .

7. **⚠ CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Install the noise suppressor (if detached) and the engine appearance cover.



8. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Crankshaft Front Seal

Special Tool(s)

ST1385-A	Remover, Oil Seal 303-409 (T92C-6700-CH)
ST2423-A	Installer, Crankshaft Front Oil Seal 303-646

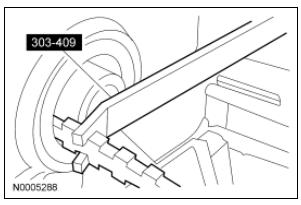
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

Removal

NOTICE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.**

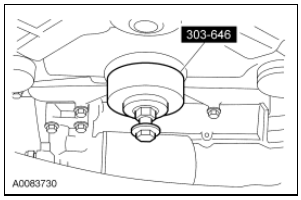
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the crankshaft pulley. For additional information, refer to Crankshaft Pulley in this section.
4. Using the special tool, remove and discard the crankshaft front seal.



Installation

1. **NOTE:** Lubricate the crankshaft front oil seal and the engine front cover mating surface with clean engine oil.

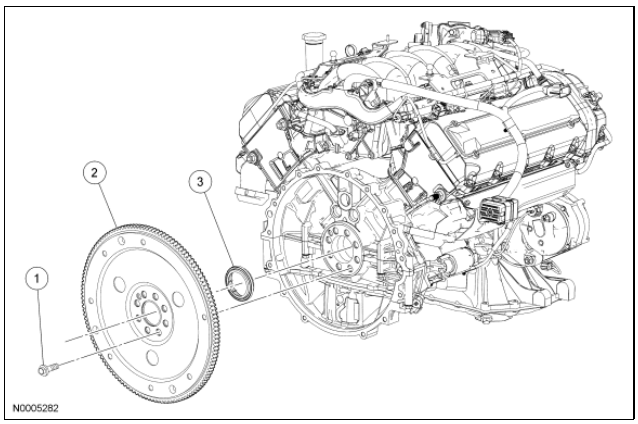
   Using the special tool, install a new crankshaft front seal.



2. Install the crankshaft pulley. For additional information, refer to Crankshaft Pulley in this section.

3. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Lower End Components — Exploded View, Flexplate and Crankshaft Rear Oil Seal



Item	Part Number	Description
1	W704862	Flexplate bolt (8 required)
2	6K375	Flexplate
3	6701	Crankshaft rear seal

1. For additional information, refer to the procedures in this section.

Flexplate

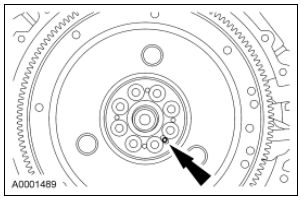
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the transmission. For additional information, refer to Section 307-01 .
3. Remove the 8 bolts and the flexplate.

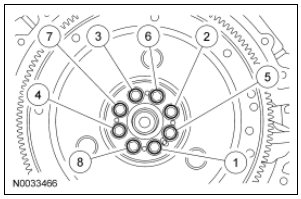
Installation

1. **NOTE:** The crankshaft dowel must be positioned below the outer face of the flexplate.

   Install the flexplate with the elongated hole over the crankshaft dowel.



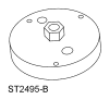
2. Install the 8 flexplate bolts and tighten in 2 stages in the sequence shown.
   - Stage 1: Tighten to 15 Nm (11 lb-ft).
   - Stage 2: Tighten to 110 Nm (81 lb-ft).



3. Install the transmission. For additional information, refer to Section 307-01 .

Crankshaft Rear Seal

Special Tool(s)

 ST2495-B	Remover/Installer, Crankshaft Rear Oil Seal 303-647
ST2441-A	Adapter for 204-185 204-208 (T95T-5310-AR2)

Material

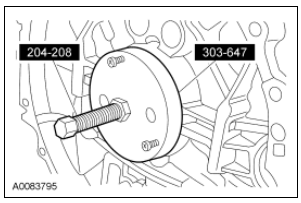
Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the flexplate. For additional information, refer to Flexplate in this section.

3. Using the special tools, remove the crankshaft rear seal.
   - Discard the seal.

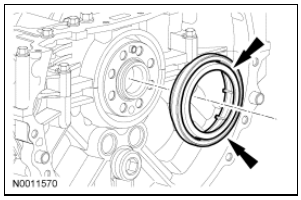


Installation

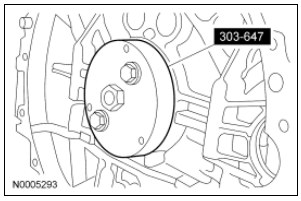
1. ***NOTICE:*** **The plastic sleeve that comes with the new crankshaft rear oil seal protects the seal while in transit and is also used as an installation tool to prevent lip seal roll when carrying out the repair. The sleeve must be used to prevent future seal concerns.**

   NOTE: Lubricate the cylinder block bore and the crankshaft with clean engine oil before installing the seal.

   Position the crankshaft rear seal with the protective installer onto the end of the crankshaft.



2. Using the special tool, install a new crankshaft rear seal.

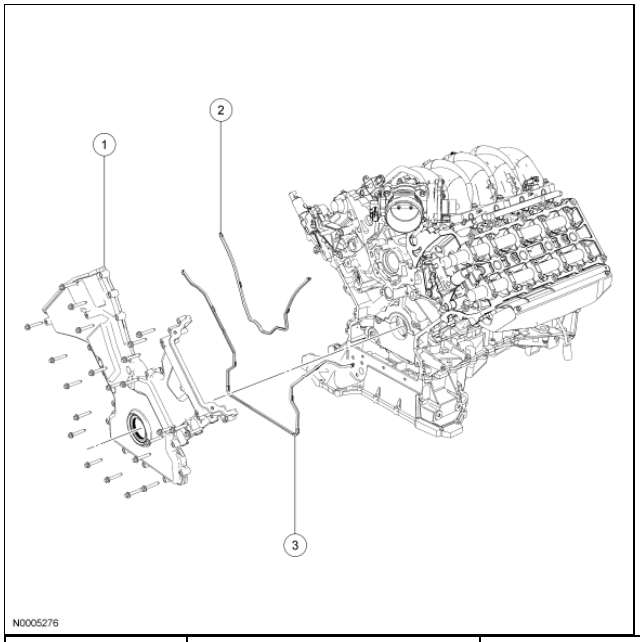


3. Install the flexplate. For additional information, refer to Flexplate in this section.

Engine Front Cover

Material

Item	Specification
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	6059	Engine front cover
2	6020	Engine front cover gasket
3	6020	Engine front cover gasket

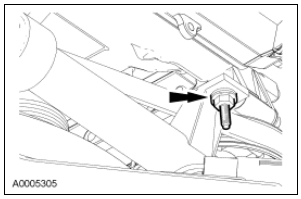
Removal

⚠ CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.

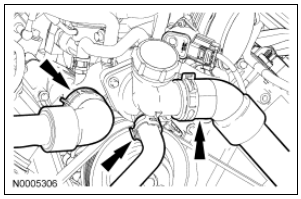
1. **⚠ CAUTION: The cooling system filling and bleeding procedure must be followed exactly or damage to the engine can occur.**

Drain the engine cooling system. For additional information, refer to Section 303-03 .

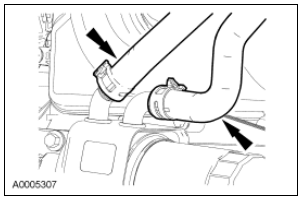
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Drain the engine oil.
4. Remove the LH valve cover. For additional information, refer to Valve Cover — LH in this section.
5. Remove the RH valve cover. For additional information, refer to Valve Cover — RH in this section.
6. Remove the engine cooling fan assembly. For additional information, refer to Section 303-03 .
7. Remove the accessory drive belt idler pulley. For additional information, refer to Section 303-05 .
8. Remove the crankshaft front seal. For additional information, refer to Lower End Components — Exploded View, Crankshaft Pulley and Crankshaft Front Seal and Crankshaft Front Seal in this section.
9. Remove the A/C compressor. For additional information, refer to Section 412-01 .
10. Remove the lower radiator hose bracket nut.



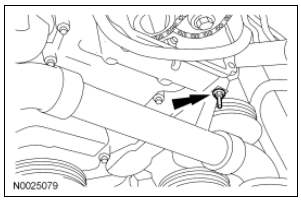
11. Disconnect the lower radiator, upper radiator and heater hose.



12. Disconnect the 2 oil cooler hoses, if equipped.



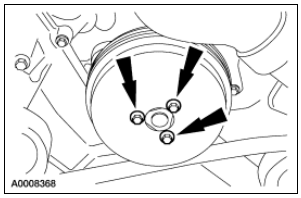
13. Remove the stud bolt.



14. **NOTE:** One bolt is blocked by the power steering pressure hose and must be removed with the power steering pump.

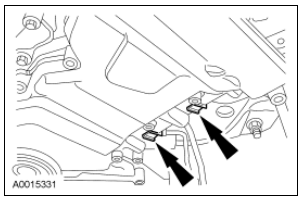
    Remove the 4 bolts and position the power steering pump aside.

15. Remove the coolant pump pulley bolts and the pulley.

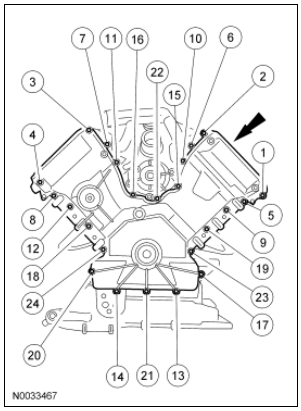


16. Remove the 5 bolts and the power steering pump bracket.

17. Detach the wiring harness clips.



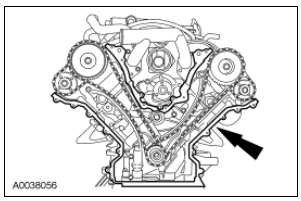
18. Remove the engine front cover bolts in the sequence shown.
    - Remove the engine front cover.



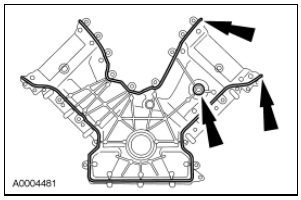
Installation

1. ⚠ **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**

   Clean the sealing surfaces with metal surface cleaner.

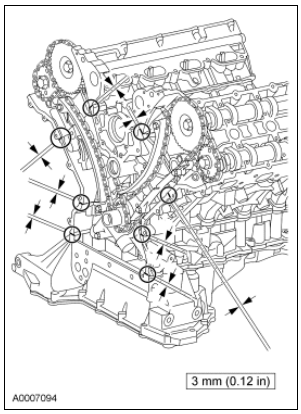


2. Install new gaskets.

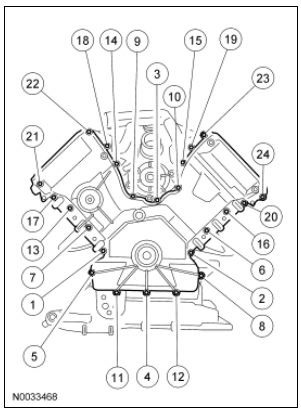


3. **NOTE:** If the front cover is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

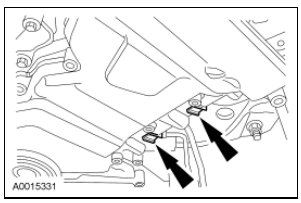
   Apply silicone gasket and sealant in the 8 locations shown.



4. Install the engine front cover.
   - Position the engine front cover on the cylinder block.
   - Loosely install the bolts.
   - Tighten the bolts in 2 stages in the sequence shown.
     - Stage 1: Tighten to 5 Nm (44 lb-in).
     - Stage 2: Tighten to 10 Nm (89 lb-in).



5. Attach the wiring harness clips.



6. **NOTE:** The wiring harness is positioned behind the bracket.

Install the power steering pump bracket and the 5 bolts.

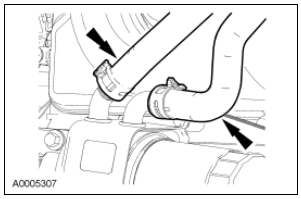
- Tighten to 25 Nm (18 lb-ft).

7. **NOTE:** One bolt is blocked by the power steering pressure line and must be installed with the power steering pump.

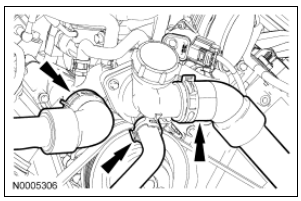
   Position the power steering pump and install the 4 bolts.

   - Tighten to 25 Nm (18 lb-ft).

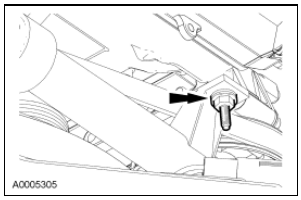
8. Connect the 2 oil cooler hoses, if equipped.



9. Connect the lower radiator, upper radiator and heater hose.



10. Install the lower radiator hose bracket nut.
    - Tighten to 10 Nm (89 lb-in).



11. Install the A/C compressor. For additional information, refer to Section 412-01 .

12. Install the crankshaft front seal. For additional information, refer to Lower End Components — Exploded View, Crankshaft Pulley and Crankshaft Front Seal and Crankshaft Front Seal in this section.

13. Install the accessory drive belt idler pulley. For additional information, refer to Section 303-05 .

14. Install the engine cooling fan assembly. For additional information, refer to Section 303-03 .

15. Install the RH valve cover. For additional information, refer to Valve Cover — RH in this section.

16. Install the LH valve cover. For additional information, refer to Valve Cover — LH in this section.

17. Fill the engine with clean engine oil.

18. Connect the battery ground cable. For additional information, refer to Section 414-01 .

19. Fill the power steering system. For additional information, refer to Section 211-00 .

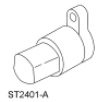
20. ⚠ **CAUTION: The cooling system filling and bleeding procedure must be followed exactly or damage to the engine can occur.**

    Fill and bleed the engine cooling system. For additional information, refer to Section 303-03 .

21. Evacuate and recharge the A/C system. For additional information, refer to Section 412-00 .

Timing Drive Components

Special Tool(s)

ST2398-B	Aligner, Camshaft 303-530
ST2399-A	Tensioning Tool, Timing Chain 303-532
 ST2401-A	Alignment Gauge, Crankshaft 303-645

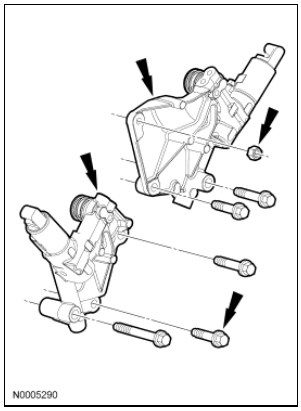
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

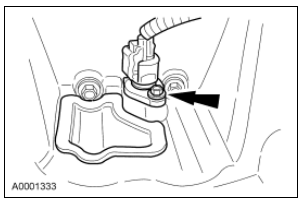
Removal

NOTICE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the engine front cover. For additional information, refer to Engine Front Cover in this section.
4. Remove the RH and LH variable cam timing (VCT) bush carriers.



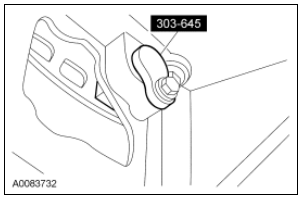
5. Remove the crankshaft position (CKP) sensor and the torque converter cover.



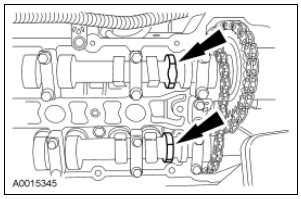
6. **NOTE:** There is one window on the ignition pulse wheel that is unique to accept the special tool.

   Install the special tool.

   - Turn the crankshaft to 45 degrees ATDC. The crankshaft keyway will be in the 6 o'clock position.
   - Install the special tool.

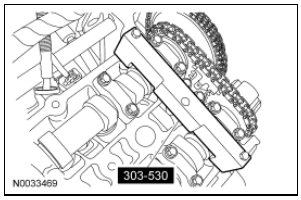


7. Make sure the flats of the camshaft are facing upward. If not, repeat Step 5.



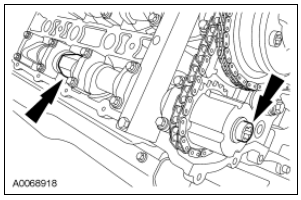
8. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

   Install the special tool on the RH cylinder head.



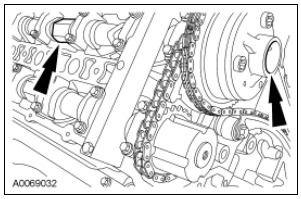
9. ***NOTICE:*** **An open-end wrench must be used on the flats of the camshaft or damage to the camshaft will occur.**

   Remove and discard the RH exhaust camshaft sprocket bolt.

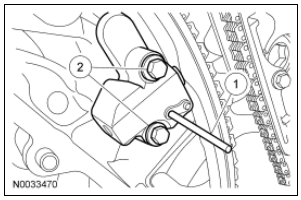


10. ***NOTICE:*** **An open-end wrench must be used on the flats of the camshaft or damage to the camshaft will occur.**

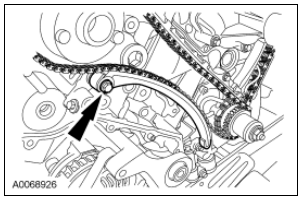
    Remove and discard the RH VCT unit bolt.



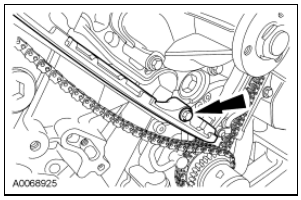
11. Remove the RH timing chain tensioner.
    1. Push the lever down and install a drill rod to lock the piston.
    2. Remove the 2 bolts and the tensioner.



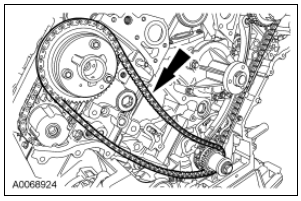
12. Remove the bolt and the RH tensioner arm.



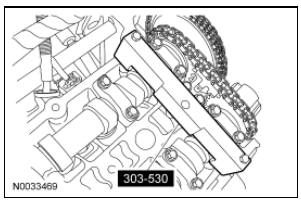
13. Remove the bolt and the RH timing chain guide.



14. Remove the RH primary timing chain.

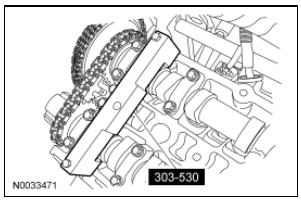


15. Remove the special tool from the RH cylinder head.



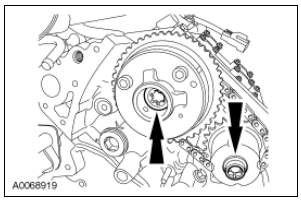
16. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

    Install the special tool on the LH head.

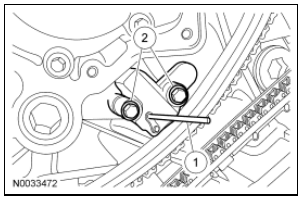


17. ***NOTICE:*** **An open-end wrench must be used on the flats of the camshaft or damage to the camshaft can occur.**

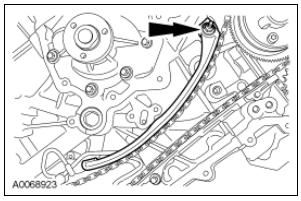
    Remove and discard the LH VCT unit bolt and the exhaust camshaft sprocket bolt.



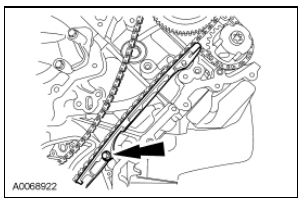
18. Remove the LH timing chain tensioner.
    1. Push the lever down and install a drill rod to lock the piston.
    2. Remove the 2 bolts and the tensioner.



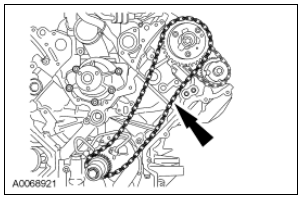
19. Remove the nut and the LH tensioner arm.



20. Remove the bolt and the LH timing chain guide.

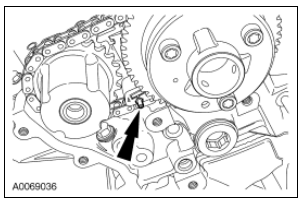


21. Remove the LH primary timing chain.

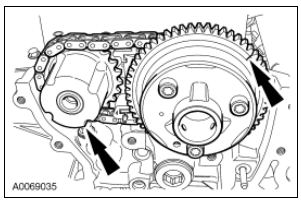


22. Remove the crankshaft sprocket.

23. Collapse the RH secondary timing chain tensioner and install a pin to lock the piston.

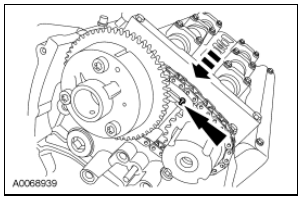


24. Remove the RH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.

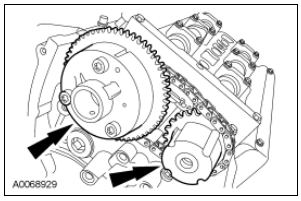


25. Remove the 2 bolts and the RH secondary timing chain tensioner.

26. Collapse the LH secondary timing chain tensioner and install a pin to lock the piston.



27. Remove the LH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.

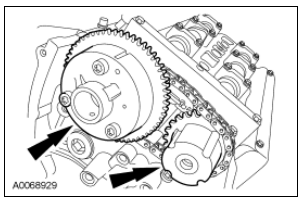


28. Remove the 2 bolts and the LH secondary timing chain tensioner.

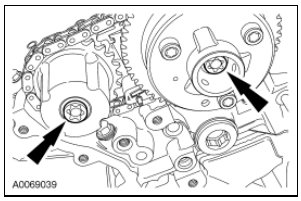
Installation

1. Install the LH secondary timing chain tensioner and 2 bolts.
   - Tighten to 11 Nm (8 lb-ft).

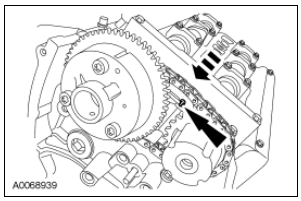
2. Install the LH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.



3. Using new bolts, install the LH VCT unit and exhaust camshaft sprocket bolts finger-tight.

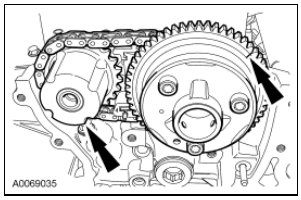


4. Remove the locking pin from the LH secondary timing chain tensioner.

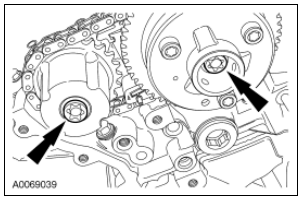


5. Install the RH secondary timing chain tensioner and 2 bolts.
   - Tighten to 11 Nm (8 lb-ft).

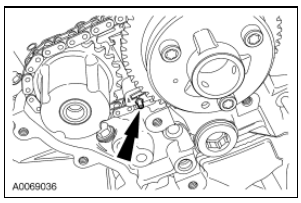
6. Install the RH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.



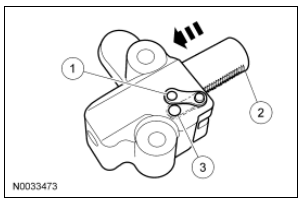
7. Using new bolts, install the RH VCT unit and exhaust camshaft sprocket bolts finger-tight.



8. Remove the locking pin from the RH secondary timing chain tensioner.



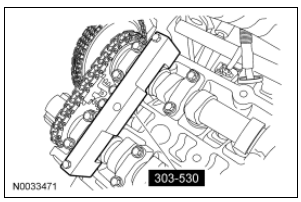
9. Reset the timing chain tensioners.
    1. Hold the lever toward the tensioner piston.
    2. Using finger pressure, compress the tensioner until it is completely collapsed.
    3. Push the lever down and install a drill rod to lock the piston.



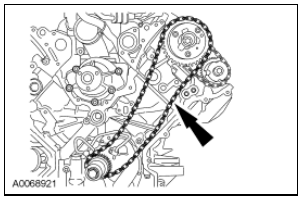
10. ***NOTICE:*** **The camshaft holding tool should still be installed on the LH cylinder head. If the special tool was removed during camshaft removal, it must be reinstalled at this time.**

    NOTICE: **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

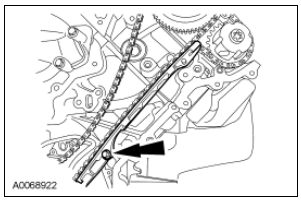
    Install the special tool on the LH cylinder head.



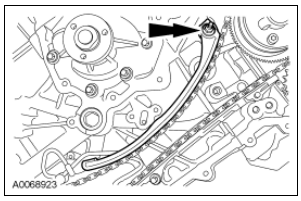
11. Position the LH timing chain and crankshaft gear.
    - Position the timing chain over the LH intake camshaft sprocket.
    - Position the crankshaft gear in the timing chain.



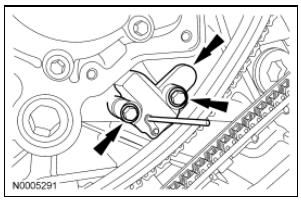
12. Install the LH timing chain guide and bolt.
    - Tighten to 11 Nm (8 lb-ft).



13. Install the LH timing chain tensioner arm and nut.
    - Tighten to 11 Nm (8 lb-ft).



14. Install the LH timing chain tensioner and 2 bolts.
    - Tighten to 11 Nm (8 lb-ft).
    - Remove the drill rod.

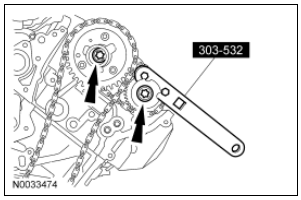


15. ***NOTICE:*** **The exhaust camshaft sprocket bolt must be fully tightened before tightening the intake camshaft sprocket bolt.**

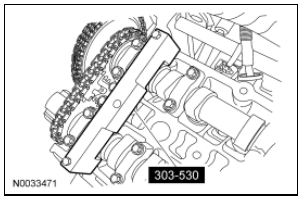
    NOTICE: **Using the special tool, apply 10 Nm (89 lb-in) counterclockwise to the LH exhaust camshaft sprocket.**

    Tighten the LH exhaust camshaft sprocket and VCT unit bolts in 2 stages:

    - Stage 1: Tighten to 35 Nm (26 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.

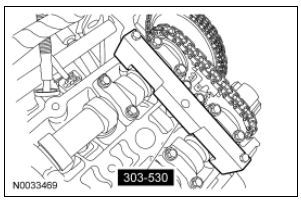


16. Remove the special tool.

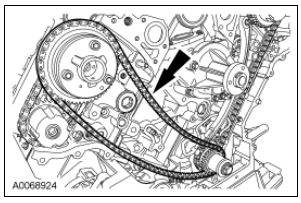


17. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

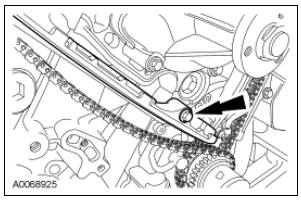
    Install the special tool on the RH cylinder head.



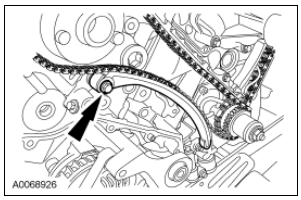
18. Position the RH timing chain over the RH intake camshaft sprocket and over the crankshaft gear.



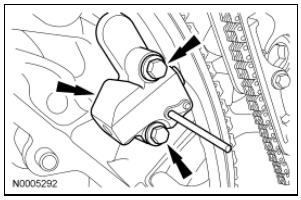
19. Install the RH timing chain guide and bolt.
    - Tighten to 11 Nm (8 lb-ft).



20. Install the RH timing chain tensioner arm.
    - Tighten to 11 Nm (8 lb-ft).



21. Install the RH timing chain tensioner and 2 bolts.
    - Tighten to 11 Nm (8 lb-ft).
    - Remove the drill rod.

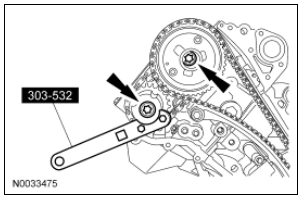


22. *NOTICE:* **The exhaust camshaft sprocket bolt must be fully tightened before tightening the intake camshaft sprocket bolt.**

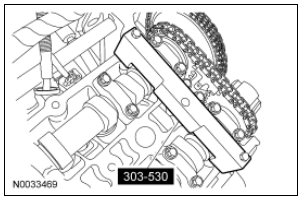
    NOTICE: **Using the special tool, apply 10 Nm (89 lb-in) counterclockwise to the RH exhaust camshaft sprocket.**

    Tighten the RH exhaust camshaft sprocket and VCT unit bolts in 2 stages:

    - Stage 1: Tighten to 35 Nm (26 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



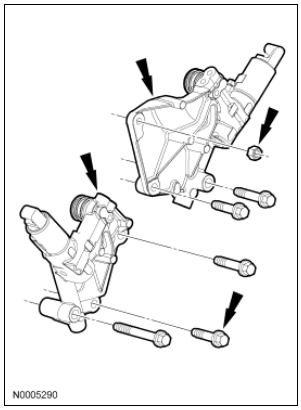
23. Remove the special tool.



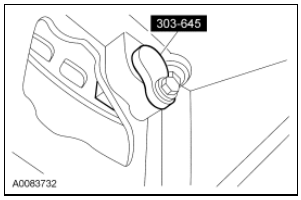
24. **NOTE:** Lubricate the VCT bush carrier seals with clean engine oil.

    Carefully insert the bush carrier into the VCT unit, compress ring seals with fingers as required. Fully seat the bush carrier by hand before fitting the bolts and nut.

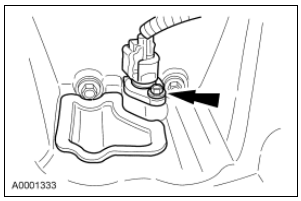
    - Tighten the bolts to 20 Nm (15 lb-ft).
    - Tighten the nut to 10 Nm (89 lb-in).



25. Remove the special tool.



26. Install the CKP sensor and the torque converter cover.
    - Tighten to 10 Nm (89 lb-in).

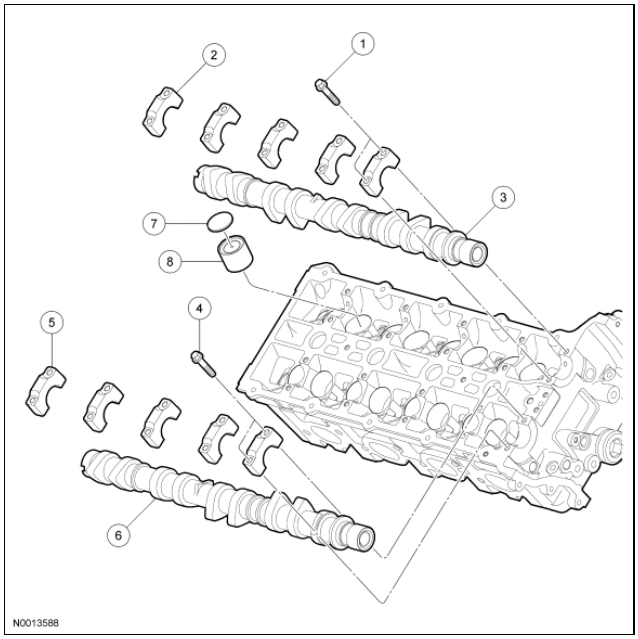


27. Install the engine front cover. For additional information, refer to Engine Front Cover in this section.

28. Connect the battery ground cable. For additional information, refer to Section 414-01 .

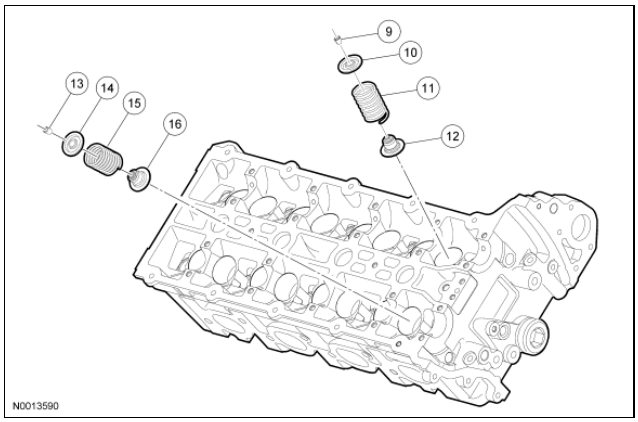
Valve Train Components — Exploded View

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	W701242	Intake camshaft cap bolt (10 required)
2	6A258	Intake camshaft cap (5 required)
3	6A270	Intake camshaft
4	W701242	Exhaust camshaft cap bolt (10 required)
5	6A258	Exhaust camshaft cap (5 required)
6	6A272	Exhaust camshaft
7	6K514	Tappet shim (16 required)
8	6500	Tappet (16 required)

NOTE: RH shown, LH similar.

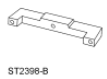


Item	Part Number	Description
9	6518	Intake valve spring retainer key (16 required)
10	2762	Intake valve spring retainer (8 required)
11	6513	Intake valve spring (8 required)
12	6A536	Intake valve stem seal (8 required)
13	6518	Exhaust valve spring retainer key (16 required)
14	2762	Exhaust valve spring retainer (8 required)
15	6513	Exhaust valve spring (8 required)
16	6A536	Exhaust valve stem seal (8 required)

1. For additional information, refer to the procedures in this section.

Camshafts

Special Tool(s)

 ST2396-B	Aligner, Camshaft 303-530

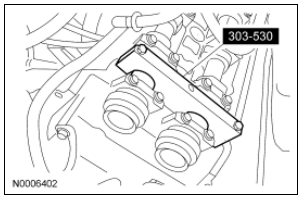
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

Removal

1. Remove the timing drive components. For additional information, refer to Timing Drive Components in this section.

2. Remove the special tool.



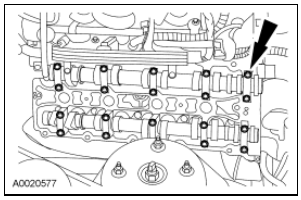
3. ***NOTICE:*** **Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

   NOTICE: **Do not use any means of marking the shims other than a permanent-type marker. Any scratches or paint on the shims can result in incorrect lash adjustments and severe engine damage.**

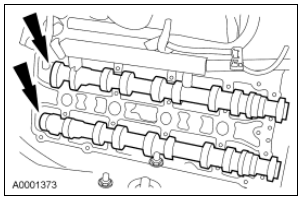
   NOTICE: **Record the shim and bucket tappet location. The shim and bucket tappet are positional and if installed in the incorrect location, engine damage can occur.**

   Remove the RH camshaft bearing caps.

   - Remove the bolts.
   - Remove the RH camshaft bearing caps.



4. Remove the RH camshafts.



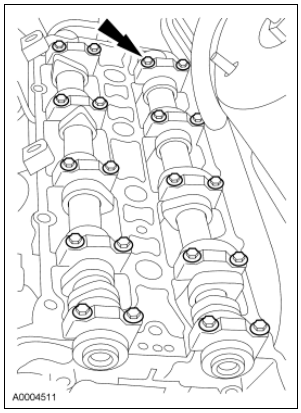
5. ***NOTICE:*** **Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

   NOTICE: **Do not use any means of marking the shims other than a permanent-type marker. Any scratches or paint on the shims can result in incorrect lash adjustments and severe engine damage.**

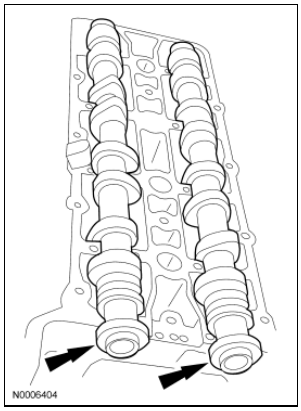
   NOTICE: **Record the location of the shims and bucket tappets. The bucket tappets and shims are positional and if installed in the incorrect location, engine damage can occur.**

   Remove the LH camshaft bearing caps.

   - Remove the bolts.
   - Remove the LH camshaft bearing caps.



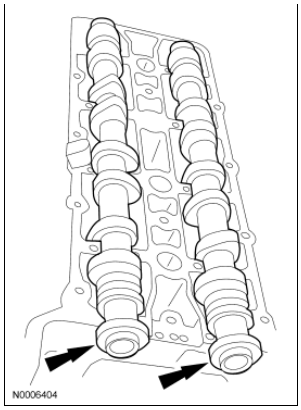
6. Remove the LH camshafts.



Installation

1. **NOTE:** Apply clean engine oil to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

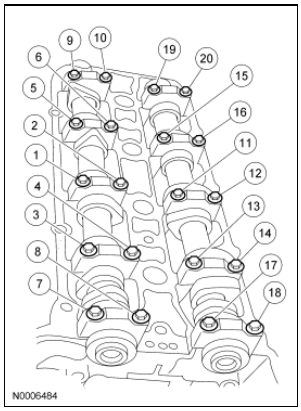
   Position the LH camshafts on the camshaft journals.



2. ***NOTICE:*** **Install the camshaft bearing caps. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

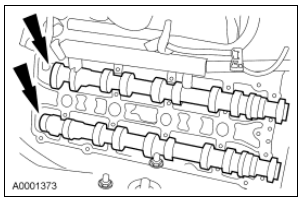
   Install the LH camshaft bearing caps.

   - Position the bearing caps.
   - Install the bearing cap bolts. Tighten the bolts in 3 stages in the sequence shown.
     - Stage 1: Hand-tighten.
     - Stage 2: Tighten to 6 Nm (53 lb-in).
     - Stage 3: Tighten an additional 90 degrees.



3. **NOTE:** Apply clean engine oil to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

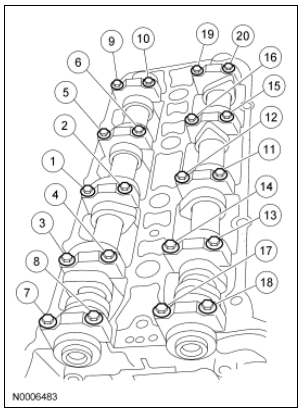
   Install the RH camshafts.



4. ***NOTICE:*** **Install the camshaft bearing caps. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

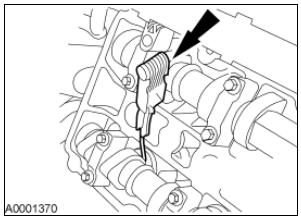
   Install the RH camshaft bearing caps.

   - Position the bearing caps.
   - Install the bolts. Tighten the bolts in 3 stages in the sequence shown.
     - ♦ Stage 1: Hand-tighten.
     - ♦ Stage 2: Tighten to 6 Nm (53 lb-in).
     - ♦ Stage 3: Tighten an additional 90 degrees.



5. ***NOTICE:*** **If any components are installed new, the engine must be reshimmed or engine damage can occur.**

   Using a feeler gauge, confirm that the tappet and shim clearances are within specification. For additional information, refer to Valve Clearance Check in this section.



6. If tappet and shim clearances are not within specification, adjust the clearance. For additional information, refer to Valve Clearance Adjustment in this section.

7. Install the timing drive components. For additional information, refer to Timing Drive Components in this section.

Valve Tappet

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

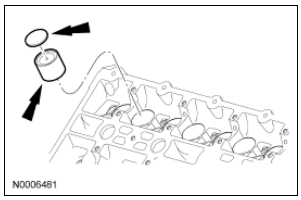
Removal and Installation

1. Remove the camshafts. For additional information, refer to Valve Train Components — Exploded View and Camshafts in this section.

2. ***NOTICE:*** **Do not use any means of marking the shims other than a permanent-type marker. Any scratches or paint on the shims can result in incorrect lash adjustments and severe engine damage.**

   NOTICE: **Record the shim and bucket tappet location. The shim and bucket tappet are positional and if installed in the incorrect location, engine damage can occur.**

   Remove the valve tappets and shims.



3. To install, reverse the removal procedure.
   - Coat the valve tappets with clean engine oil prior to installing.

Valve Spring, Retainer, and Seal

Special Tool(s)

ST2489-A	Compressor, Valve Spring 303-648

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

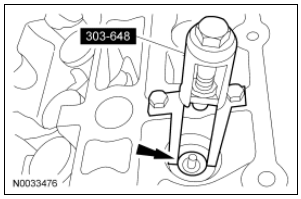
Removal

1. Remove the valve tappets. For additional information, refer to Valve Train Components — Exploded View and Valve Tappet in this section.

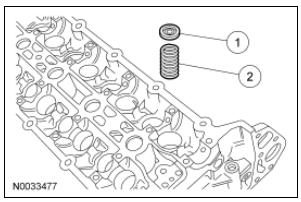
2. Remove the spark plug. For additional information, refer to Section 303-07 .

3. Position the piston for the cylinder being serviced at the top of its stroke and pressurize the cylinder with compressed air.

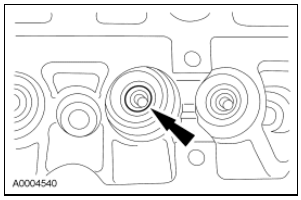
4. Using the special tool, compress the valve spring and remove the retainer keys.



5. Remove the valve spring.
    1. Remove the retainer.
    2. Remove the valve spring.



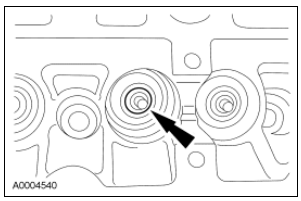
6. Remove and discard the valve stem seal.



Installation

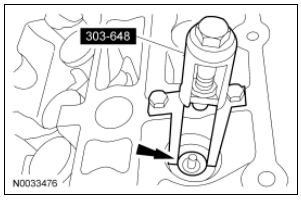
1. **NOTE:** Lubricate the valve stem seal with clean engine oil.

   Install the valve stem seal.



2. Install the valve spring and retainer.

3. Using the special tool, compress the valve spring and install the retainer keys.



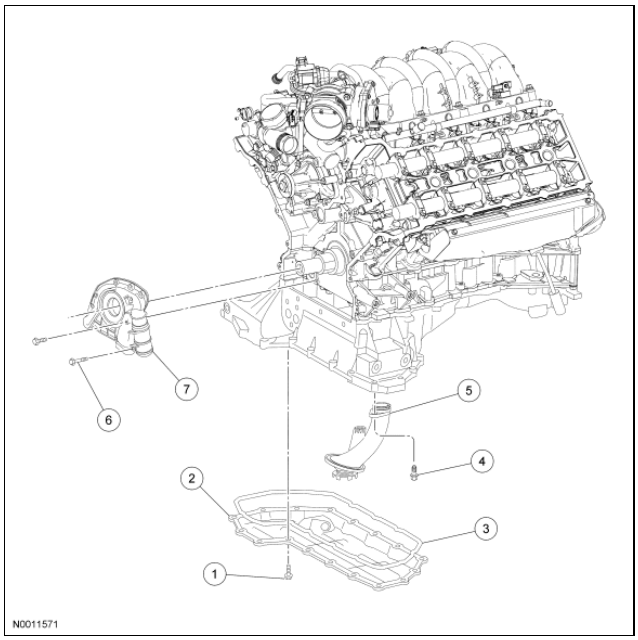
4. Release the compressed air used to hold the valves closed.

5. Repeat the appropriate removal and installation steps for all of the other cylinders.

6. Install the spark plugs. For additional information, refer to Section 303-07 .

7. Install the valve tappets. For additional information, refer to Valve Train Components — Exploded View and Valve Tappet in this section.

Engine Lubrication Components — Exploded View, Oil Pan, Oil Pump, Oil Pump Screen and Pickup Tube



Item	Part Number	Description
1	W701504	Oil pan bolt (17 required)
2	6695	Oil pan
3	6710	Oil pan gasket
4	W500214	Oil pump screen and pickup tube bolt (2 required)
5	6617	Oil pump screen and pickup tube
6	W701544	Oil pump bolt (2 required)
7	6600	Oil pump

1. For additional information, refer to the procedures in this section.

Oil Pan

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

NOTICE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the engine oil.

3. Remove and discard the oil filter.

4. Remove the 17 bolts and the oil pan.
   - Discard the gasket.

Installation

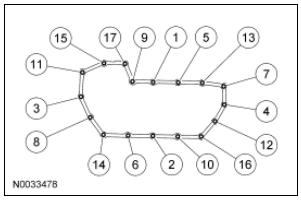
1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leaks paths. Use a plastic scraping tool to remove all traces of sealant.**

   Clean the gasket sealing surfaces.

2. **NOTE:** Make sure all gasket sealing surfaces are clean and dry.

   Install a new oil pan gasket, oil pan and 17 bolts.

   - Tighten the bolts in the sequence shown in 2 stages.
     - Stage 1: Tighten to 5 Nm (44 lb-in).
     - Stage 2: Tighten to 12 Nm (9 lb-ft).



3. **NOTE:** Lubricate the oil filter gasket with clean engine oil.

   Install a new oil filter until the gasket seal makes contact.

   - Tighten the oil filter an additional 270 degrees.

4. Fill the engine with clean engine oil.

Oil Pump

Removal

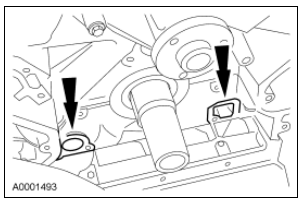
NOTICE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the oil pump screen and pickup tube. For additional information, refer to Engine Lubrication Components — Exploded View, Oil Pan, Oil Pump, Oil Pump Screen and Pickup Tube and Oil Pump Screen and Pickup Tube in this section.
4. Remove the timing drive components. For additional information, refer to Timing Drive Components in this section.
5. Remove the bolts and the oil pump.

Installation

1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leaks paths. Use a plastic scraping tool to remove all traces of sealant.**

   Clean the sealing surfaces.



2. Install the oil pump and tighten the bolts in 2 stages.
   - Stage 1: Tighten to 6 Nm (53 lb-in).
   - Stage 2: Tighten an additional 90 degrees.
3. Install the timing drive components. For additional information, refer to Timing Drive Components in this section.
4. Install the oil pump screen and pickup tube. For additional information, refer to Engine Lubrication Components — Exploded View, Oil Pan, Oil Pump, Oil Pump Screen and Pickup Tube and Oil Pump Screen and Pickup Tube in this section.
5. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Oil Pump Screen and Pickup Tube

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal and Installation

NOTICE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the oil pan. For additional information, refer to Engine Lubrication Components — Exploded View, Oil Pan, Oil Pump, Oil Pump Screen and Pickup Tube and Oil Pan in this section.

3. ***NOTICE:*** **Only use hand tools to remove the oil pump screen and pickup tube.**

   Remove the bolts and the oil pump screen and pickup tube.

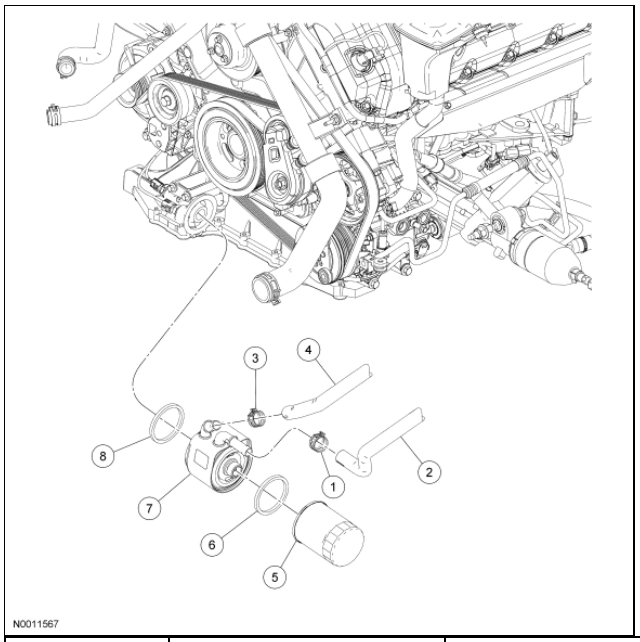
   - To install, tighten to 12 Nm (9 lb-ft).

4. To install, reverse the removal procedure.
   - Inspect the O-ring seal and install a new one if necessary.
   - Lubricate the O-ring seal with clean engine oil.

Oil Cooler

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	8A593	Oil cooler coolant hose clamp
2	8286	Oil cooler coolant hose
3	8A593	Oil cooler coolant hose clamp
4	8286	Oil cooler coolant hose
5	6714	Oil filter
6	—	Oil filter seal (part of 6714)
7	6A642	Oil cooler
8	6A636	Oil cooler gasket

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. ***NOTICE:*** **The cooling system filling and bleeding procedure must be followed exactly or damage to the engine can occur.**

Drain the engine cooling system. For additional information, refer to Section 303-03 .

3. Drain the engine oil.

4. Disconnect the 2 coolant hoses from the oil cooler.

5. Remove and discard the oil filter and gasket.

6. *NOTICE:* **If metal or aluminum material is present in the oil cooler, mechanical concerns exist. To diagnose mechanical concerns, refer to Section 303-00 .**

   Remove the bolt and the oil cooler.

   - Discard the gasket.
   - Inspect the oil cooler.

Installation

1. **NOTE:** Inspect the gasket and surfaces for contamination prior to installation. Lubricate the gasket with clean engine oil.

   Position the oil cooler and a new gasket and install the bolt.

   - Rotate the cooler clockwise until the locating pin hits the stop.
   - Tighten the bolt to 60 Nm (44 lb-ft).

2. **NOTE:** Lubricate the gasket with clean engine oil.

   Install a new oil filter and gasket until the seal makes contact.

   - Using an oil filter strap wrench, tighten the filter an additional 270 degrees.

3. Connect the 2 coolant hoses to the oil cooler.

4. Fill the engine with clean engine oil.

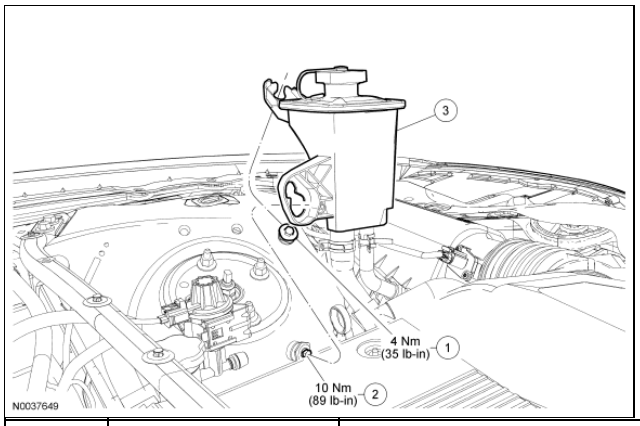
5. *NOTICE:* **The cooling system filling and bleeding procedure must be followed exactly or damage to the engine can occur.**

   Fill and bleed the engine cooling system. For additional information, refer to Section 303-03 .

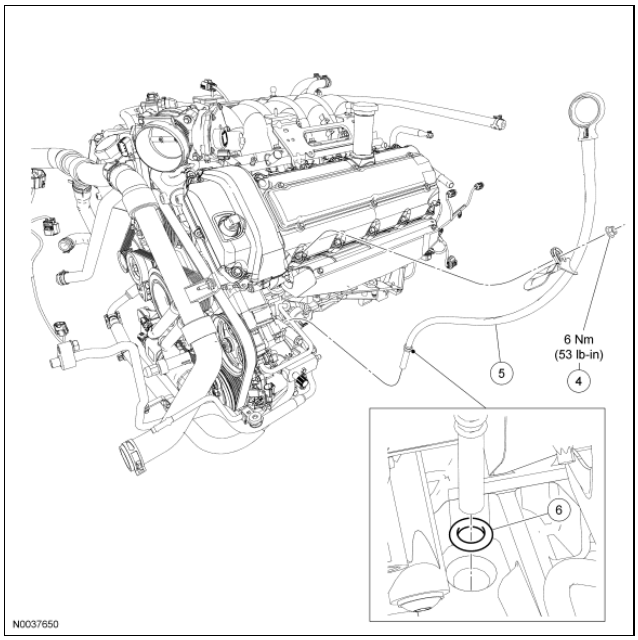
Oil Level Indicator and Tube

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	N803882	Upper power steering reservoir isolator bolt
2	W705012-S306	Lower power steering reservoir isolator bolt
3	3E764	Power steering fluid reservoir



Item	Part Number	Description
4	W520411	Oil level indicator tube nut
5	6754	Oil level indicator tube
6	6754-B	O-ring seal

Removal and Installation

1. Loosen the upper power steering fluid reservoir isolator bolt.
   - To install, tighten to 4 Nm (35 lb-in).

2. Loosen the lower power steering fluid reservoir isolator bolt.
   - To install, tighten to 10 Nm (89 lb-in).

3. Lift the power steering fluid reservoir upward off of the isolators and position aside.

4. Remove the nut and the oil level indicator tube.
   - Discard the O-ring seal.
   - To install, tighten to 6 Nm (53 lb-in).

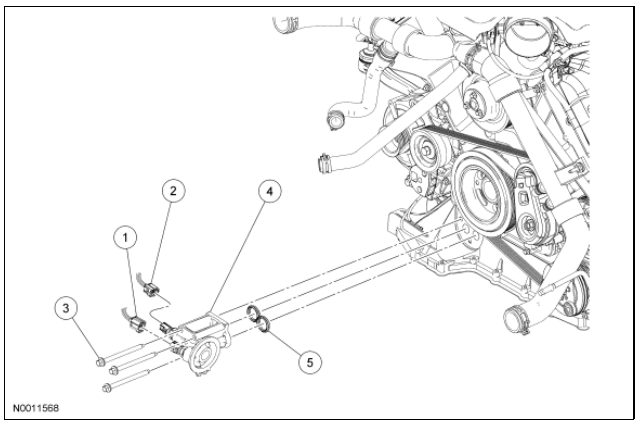
5. ***NOTICE:*** **Failure to lubricate the O-ring seal and the oil level indicator tube-to-engine block mating surface with clean engine oil can result in engine oil leaks.**

   NOTICE: **Make sure the O-ring seal remains in position and does not roll up the indicator tube during installation.**

   To install, reverse the removal procedure.

   - Lubricate the new O-ring seal and engine mating surface with clean engine oil.

Oil Filter Adapter



Item	Part Number	Description
1	12B637	Oil temperature sensor electrical connector (part of 12B637)
2	12B637	Oil pressure sensor electrical connector (part of 12B637)
3	W70709	Oil filter adapter bolt (3 required)
4	6A643	Oil filter adapter
5	6A636	Oil filter adapter O-ring seal (2 required)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the engine oil cooler. For additional information, refer to Oil Cooler in this section.
4. Remove the lower splash shield.
5. Disconnect the oil temperature sensor electrical connector.
6. Disconnect the oil pressure sensor electrical connector.
7. Remove the 3 bolts and the oil filter adapter.
   - Discard the seals.

Installation

1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool.**

   Clean the sealing surfaces.

2. Install the oil filter adapter, a new seal and 3 bolts.
    - Tighten in 2 stages.
        - Stage 1: Tighten to 13 Nm (10 lb-ft).
        - Stage 2: Tighten an additional 90 degrees.

3. Connect the oil pressure sensor electrical connector.

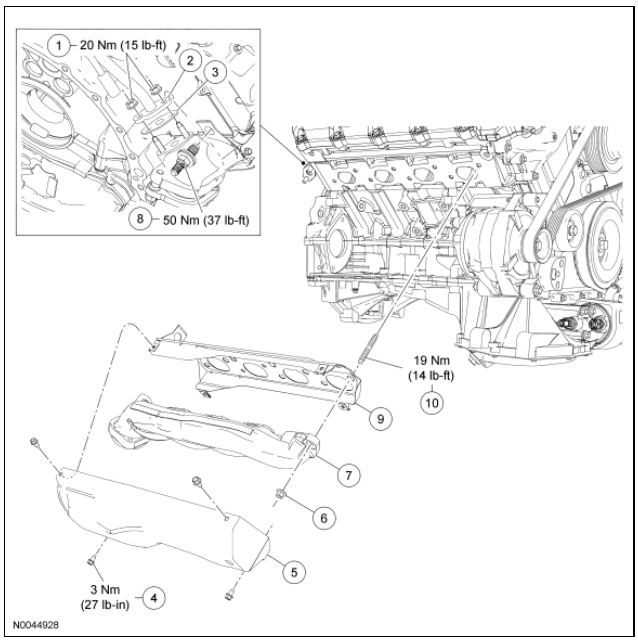
4. Connect the oil temperature sensor electrical connector.

5. Install the lower splash shield.

6. Install the engine oil cooler. For additional information, refer to Oil Cooler in this section.

7. Connect the battery ground cable. For additional information, refer to Section 414-01 .

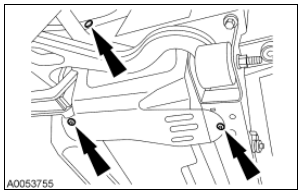
Exhaust Manifold — RH



Item	Part Number	Description
1	W520413	Exhaust gas recirculation (EGR) tube flange nuts (2 required)
2	7D477	EGR tube
3	9C435	EGR tube gasket
4	W504081	Heat shield bolt (4 required)
5	9A462	Heat shield
6	W701706	Exhaust manifold nut (8 required)
7	9430	Exhaust manifold
8	W708246	Stud bolt
9	9448	Exhaust manifold gasket
10	9K492	Exhaust manifold stud (8 required)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the catalytic converters. For additional information, refer to Section 309-00 .
3. Remove the fresh air inlet duct. For additional information, refer to Section 412-01 .
4. Remove the 2 EGR tube flange nuts.
5. Remove the starter motor. For additional information, refer to Section 303-06 .
6. Remove the screws and the lower RH splash shield.



7. Remove the 4 bolts and the heat shield.

8. Remove the 8 nuts and the exhaust manifold.

9. Remove the heat shield stud bolt.
    - Discard the exhaust manifold and EGR tube gaskets.

10. Remove the 8 exhaust manifold studs and discard.

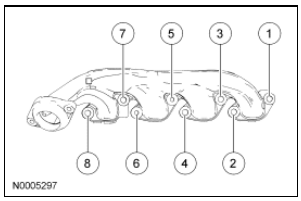
11. Clean and inspect the exhaust manifold. For additional information, refer to Section 303-00 .

Installation

1. Install the 8 new exhaust manifold studs.
    - Tighten to 19 Nm (14 lb-ft).

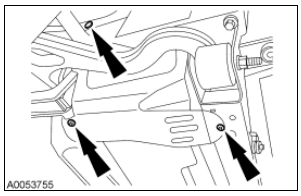
2. Position the new exhaust manifold gasket and install the heat shield stud bolt.
    - Tighten to 50 Nm (37 lb-ft).

3. Position the exhaust manifold and the new EGR tube gasket.
    - Install the 8 new exhaust manifold nuts hand-tight.
    - Install the EGR tube nuts and tighten to 20 Nm (15 lb-ft).
    - Tighten the 8 nuts to 25 Nm (18 lb-ft) in the sequence shown.



4. Install the heat shield and 4 bolts.
    - Tighten to 3 Nm (27 lb-in).

5. Install the lower RH splash shield and screws.

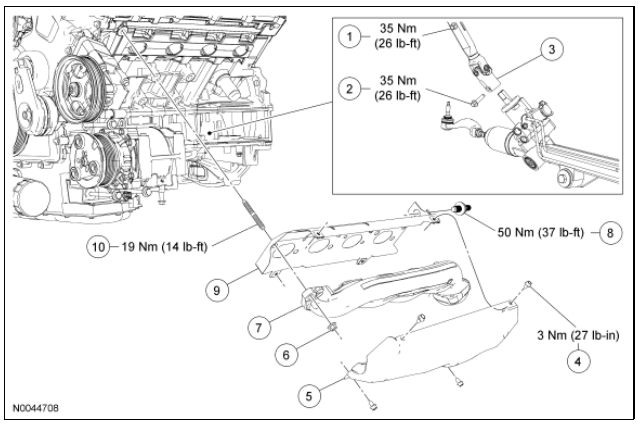


6. Install the starter motor. For additional information, refer to Section 303-06 .

7. Install the fresh air inlet duct. For additional information, refer to Section 412-01 .

8. Install the catalytic converters. For additional information, refer to Section 309-00 .

Exhaust Manifold — LH



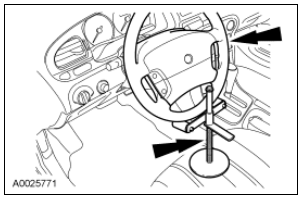
Item	Part Number	Description
1	—	Intermediate shaft slider bolt
2	W705113	Intermediate shaft-to-steering gear bolt
3	3B676	Intermediate shaft
4	W504081	Heat shield bolt (4 required)
5	9Y427	Heat shield
6	W701706	Exhaust manifold nut (8 required)
7	9431	Exhaust manifold
8	W708246	Heat shield stud bolt
9	9A457	Exhaust manifold gasket
10	9K492	Exhaust manifold stud (8 required)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. ***NOTICE:*** **Do not allow the steering wheel to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   Hold the steering wheel in the straight-ahead position using a suitable holding device.



3. Remove the catalytic converters. For additional information, refer to Section 309-00 .

4. Loosen the intermediate shaft slider bolt.

5. Remove and discard the intermediate shaft-to-steering gear bolt and disconnect the intermediate shaft from the steering gear.

6. Remove the oil level indicator tube. For additional information, refer to Oil Level Indicator and Tube in this section.

7. Remove the screws and the lower LH splash shield.

8. Remove the 4 bolts and the heat shield.

9. Remove the 8 nuts and the exhaust manifold.
   - Discard the nuts.

10. Remove the heat shield stud bolt.
    - Discard the exhaust manifold gasket.

11. Remove the 8 exhaust manifold studs and discard.

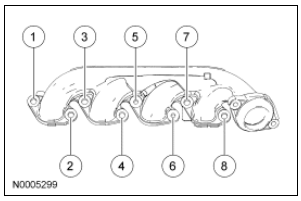
12. Clean and inspect the exhaust manifold. For additional information, refer to Section 303-00 .

Installation

1. Install the 8 new exhaust manifold studs.
   - Tighten to 19 Nm (14 lb-ft).

2. Install the new exhaust manifold gasket and the heat shield stud bolt.
   - Tighten to 50 Nm (37 lb-ft).

3. Install the exhaust manifold and 8 new nuts.
   - Tighten to 25 Nm (18 lb-ft) in the sequence shown.



4. Install the heat shield and 4 bolts.
   - Tighten to 3 Nm (27 lb-in).

5. Install the lower LH splash shield and screws.

6. Install the oil level indicator tube. For additional information, refer to Oil Level Indicator and Tube in this section.

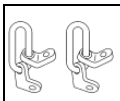
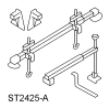
7. Connect the intermediate shaft to the steering gear and install the new intermediate shaft-to-steering gear bolt.
   - Tighten to 35 Nm (26 lb-ft).

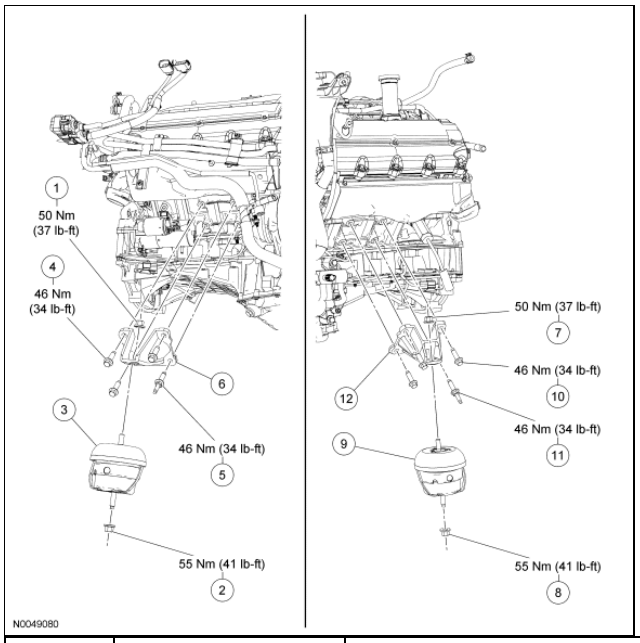
8. Tighten the intermediate shaft slider bolt.
   - Tighten to 35 Nm (26 lb-ft).

9. Install the catalytic converters. For additional information, refer to Section 309-00 .

Engine Mount

Special Tool(s)

 ST1595-A	Lifting Bracket, Engine 303-050 (T70P-6000)
 ST2425-A	Three-Bar Engine Support Kit 303-F072



Item	Part Number	Description
1	6A005	RH engine mount upper nut
2	N621942-S441	RH engine mount lower nut
3	6754B	RH engine mount
4	W500234	RH engine mount bracket bolt (3 required)
5	W705399	RH engine mount bracket stud bolt
6	6061	RH engine mount bracket
7	6A005	LH engine mount upper nut
8	N621942-S441	LH engine mount lower nut
9	6754B	LH engine mount
10	W500234	LH engine mount bracket bolt (3 required)
11	W705399	LH engine mount bracket stud bolt
12	6057	LH engine mount bracket

Removal and Installation

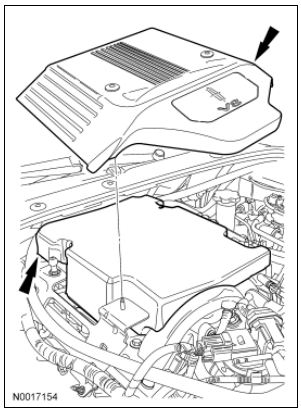
Both sides

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. ***NOTICE:*** **The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

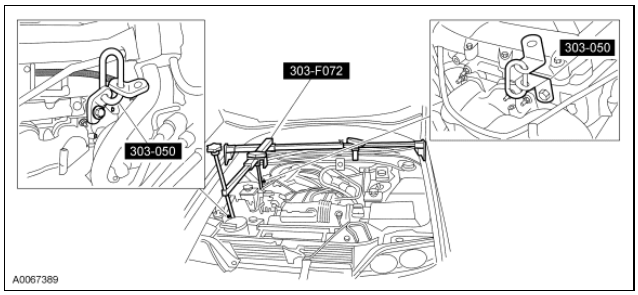
   Remove the engine appearance cover and the noise suppressor (if detached).



4. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

5. Remove the upper radiator sight shield.

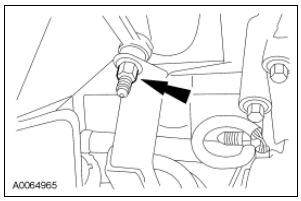
6. Install the special tools and support the engine.



RH side

7. Remove the RH lower splash shield.

8. Remove the nut and disconnect the transmission cooling tube support bracket from the engine mount bracket.
   - To install, tighten to 10 Nm (89 lb-in).



9. Remove the RH engine mount upper nut.
   - To install, tighten to 50 Nm (37 lb-ft).

10. Remove the 3 bolts, the stud bolt and the RH engine mount bracket.
    - To install, tighten to 46 Nm (34 lb-ft).

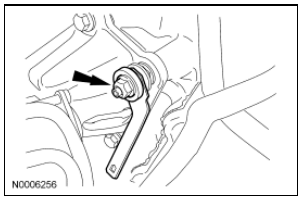
11. Remove the lower nut and the RH engine mount.
    - To install, tighten to 55 Nm (41 lb-ft).

LH side

12. Remove the LH lower splash shield.

13. Remove the LH engine mount upper nut.
    - To install, tighten to 50 Nm (37 lb-ft).

14. Remove the nut and the power steering tube support bracket.
    - To install, tighten to 10 Nm (89 lb-in).



15. Remove the 3 bolts, stud bolt and LH engine mount bracket.
    - To install, tighten to 46 Nm (34 lb-ft).

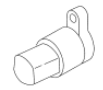
16. Remove the lower nut and the LH engine mount.
    - To install, tighten to 55 Nm (41 lb-ft).

Both sides

17. To install, reverse the removal procedure.

Cylinder Heads

Special Tool(s)

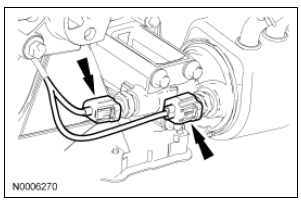
ST1438-A	Strap Wrench 303-D055
ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
ST1385-A	Remover, Oil Seal 303-409 (T92C-6700-CH)
 ST2401-A	Alignment Gauge, Crankshaft 303-645
ST2398-B	Aligner, Camshaft 303-530

Material

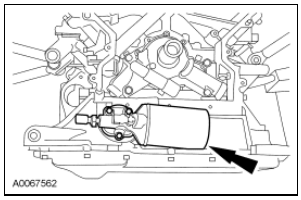
Item	Specification
Silicone Gasket Remover ZC-30	—
Motorcraft Metal Surface Prep ZC-31	—

Both sides

1. Remove the engine. For additional information, refer to Engine in this section.
2. Install the engine on a suitable engine stand.
3. Remove the engine block plug to drain the engine coolant.
4. Disconnect the oil pressure and oil temperature sensor electrical connectors.


N0006270

5. Remove and discard the oil filter.

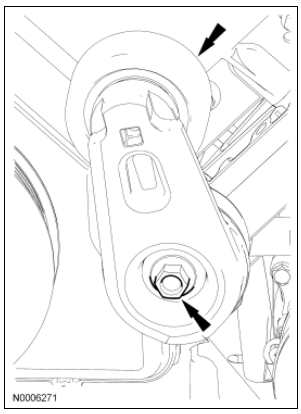


6. ***NOTICE:*** **A new oil cooler must be installed or severe damage to the engine can occur.**

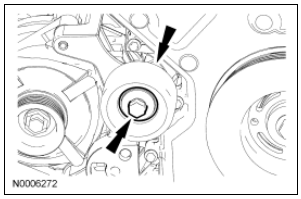
   Remove the bolt and oil cooler.

   - Discard the oil cooler and gasket.

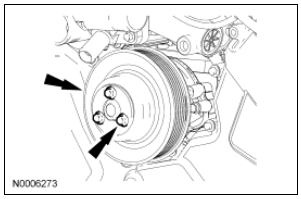
7. Remove the bolt and the accessory drive belt tensioner.



8. Remove the bolt and the accessory drive belt idler pulley.

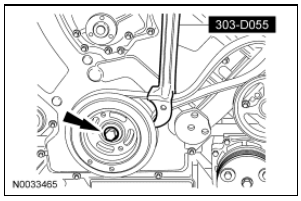


9. Remove the 3 bolts and the coolant pump pulley.

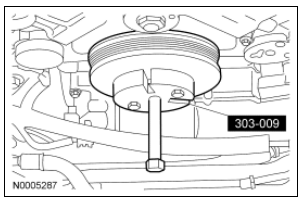


10. **NOTE:** Hold the crankshaft pulley with the special tool while removing the bolt and washer.

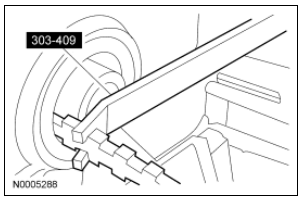
    Remove and discard the bolt and washer.



11. Using the special tool, remove the crankshaft damper.



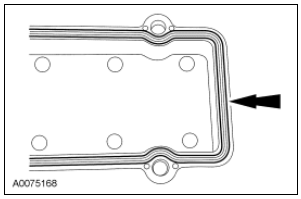
12. Using the special tool, remove and discard the front crankshaft seal.



13. **NOTE:** LH shown, RH similar.

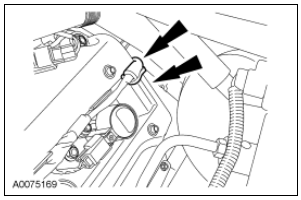
    Remove the LH and RH ignition coil covers.

14. Remove all silicone sealer and residue from the ignition coil covers.

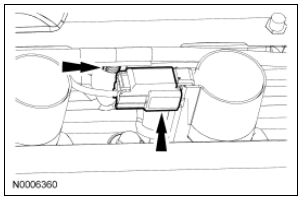


15. **NOTE:** LH shown, RH similar.

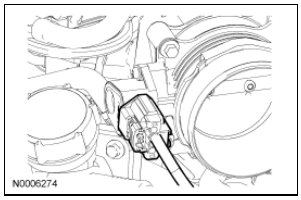
    Remove all silicone sealer and residue from the valve cover surface and ignition coil wiring harness.



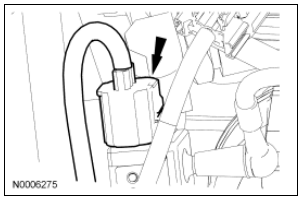
16. Disconnect the 8 ignition coil electrical connectors.



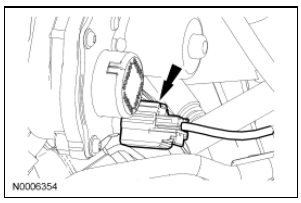
17. Disconnect the throttle position (TP) sensor electrical connector.



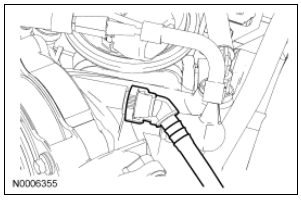
18. Disconnect the fuel pressure sensor electrical connector.



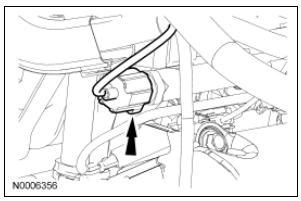
19. Disconnect the electronic throttle body electrical connector.



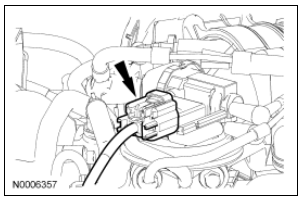
20. Disconnect the evaporative emissions (EVAP) tube.



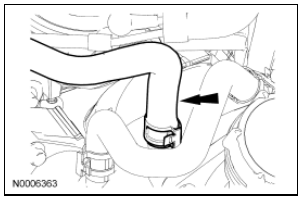
21. Disconnect the fuel rail temperature sensor electrical connector.



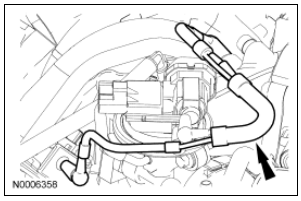
22. Disconnect the exhaust gas recirculation (EGR) system module electrical connector.



23. Disconnect the coolant vent hose from the coolant outlet.
    - Remove the coolant vent hose.

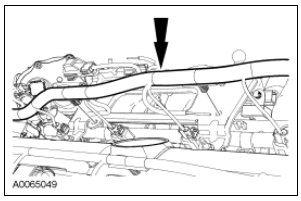


24. Remove the vacuum harness.

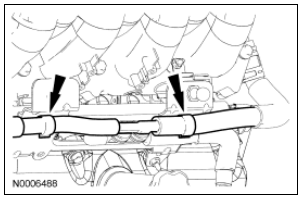


25. **NOTE:** LH shown, RH similar.

    Disconnect the engine wiring harness retainers from the engine appearance cover support brackets.

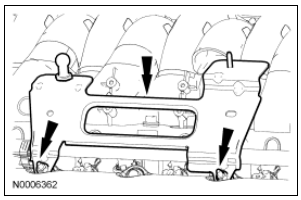


26. Detach the vacuum hose retainers from the LH engine appearance cover support bracket.



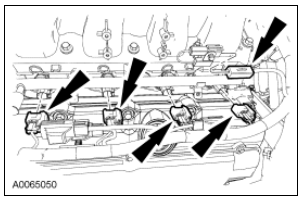
27. **NOTE:** RH shown, LH similar.

    Remove the 4 nuts and the 2 engine appearance cover brackets.

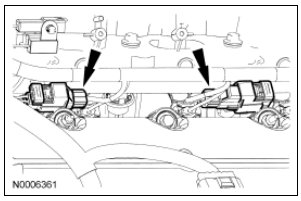


28. **NOTE:** LH shown, RH similar.

    Disconnect the 8 fuel injector and the 2 radio interference capacitor electrical connectors.

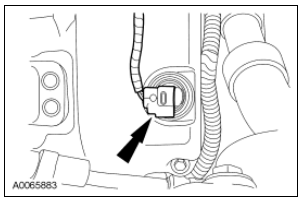


29. Disconnect the knock sensor (KS) and camshaft position (CMP) senor electrical connectors.
    - Detach the pin-type retainers.

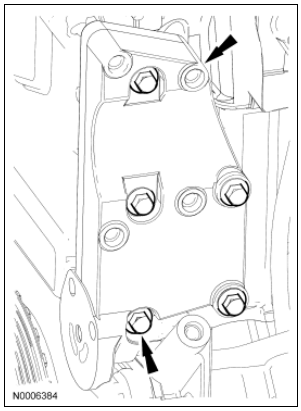


30. **NOTE:** RH shown, LH similar.

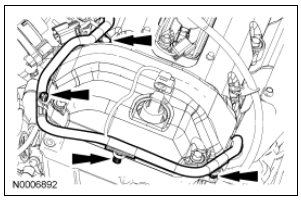
    Disconnect the 2 variable cam timing (VCT) sensor electrical connectors.



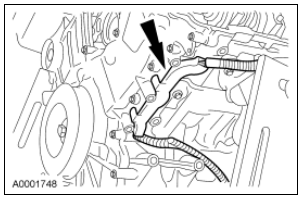
31. Remove the 5 bolts and the power steering bracket.



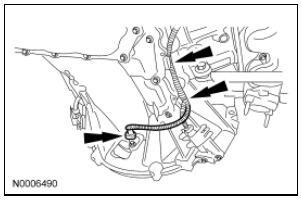
32. Disconnect the wiring harness retainers from the LH valve cover.



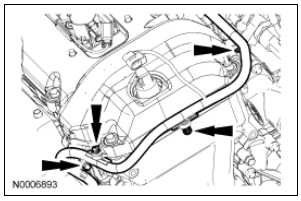
33. Detach the wiring harness from the engine front cover.



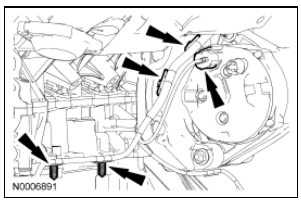
34. Disconnect the crankshaft position (CKP) sensor electrical connector and wiring harness retainers.



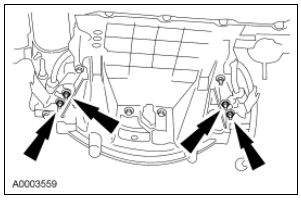
35. Disconnect the wiring harness retainers from the RH valve cover.



36. Disconnect the generator electrical connector and wiring harness retainers.

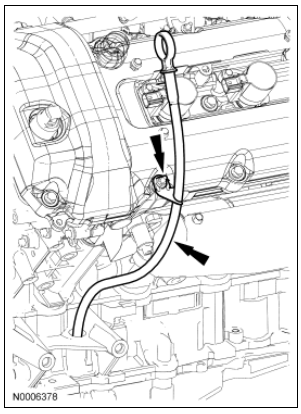


37. Remove the heated oxygen sensor (HO2S) electrical connectors from the brackets.

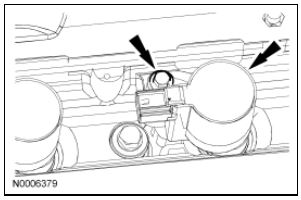


38. Remove the engine wiring harness from the engine.

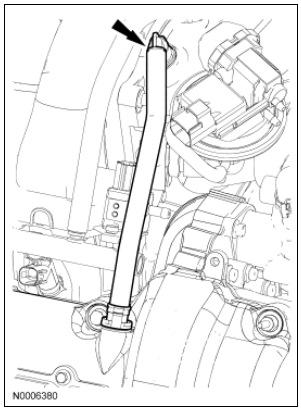
39. Remove the nut and the oil level indicator tube.
    - Discard the O-ring seal.



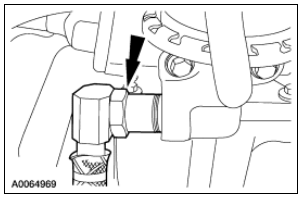
40. Remove the 8 bolts and the 8 ignition coils.



41. Remove the crankcase vent tube.

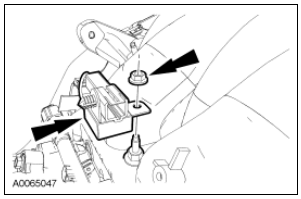


42. Disconnect the exhaust manifold tube at the EGR system module.

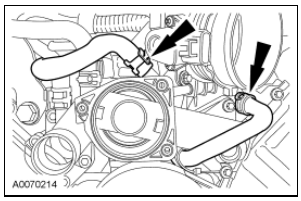


43. **NOTE:** RH shown, LH similar.

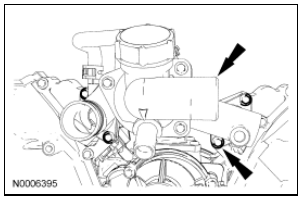
    Remove the 2 nuts and the radio interference capacitors.



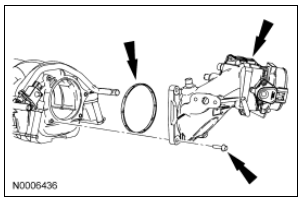
44. Disconnect the throttle body heater hoses.



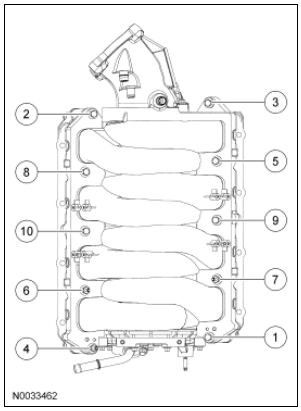
45. Remove the 4 bolts and the coolant bypass housing.
    - Discard the O-ring seals.



46. Remove the 4 bolts and the throttle body adapter.
    - Discard the gasket.

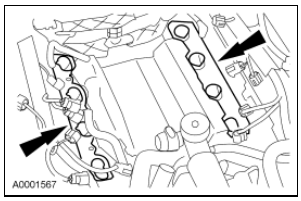


47. Remove the 7 bolts and 3 studs in the sequence shown.
    - Remove the intake manifold.
    - Discard the gaskets.

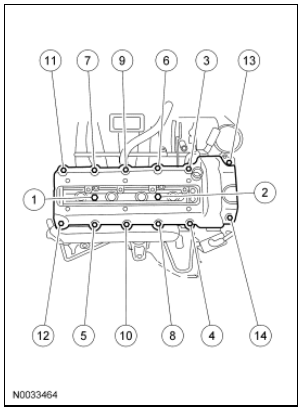


48. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to clean the surfaces.**

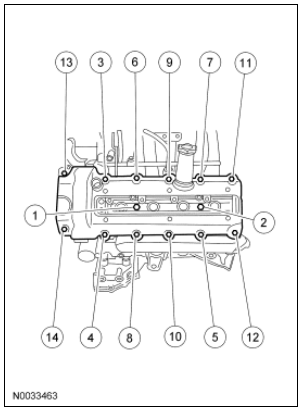
    Clean the sealing surfaces.



49. Remove the bolts in the sequence shown and remove the RH valve cover.
    - Discard the gasket.

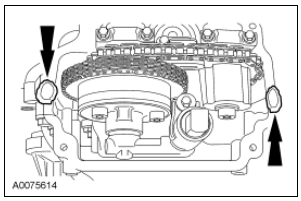


50. Remove the bolts in the sequence shown and remove the LH valve cover.



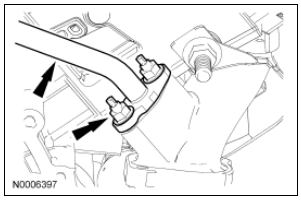
51. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to clean the surfaces.**

    Remove the gaskets and all silicone sealer. Clean the mating surfaces with silicone gasket remover.

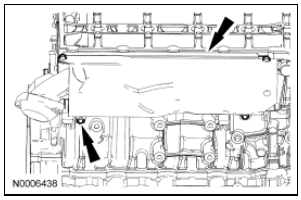


RH side

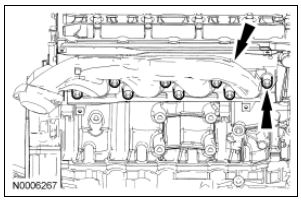
52. Remove the 2 nuts and the EGR tube.
    - Discard the gasket.



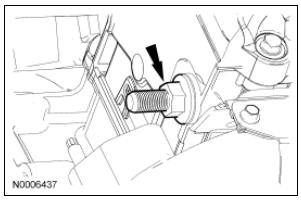
53. Remove the 4 bolts and the RH exhaust manifold heat shield.



54. Remove the nuts and the RH exhaust manifold.
    - Discard the nuts.



55. Remove the RH exhaust manifold heat shield stud bolt.
    - Discard the exhaust manifold gasket.

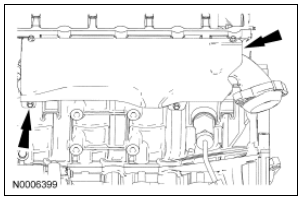


56. Remove the 8 RH exhaust manifold studs and discard.

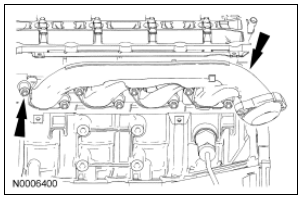
57. Clean and inspect the RH exhaust manifold. For additional information, refer to Section 303-00 .

LH side

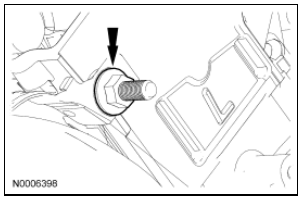
58. Remove the 4 bolts and the LH exhaust manifold heat shield.



59. Remove the nuts and the LH exhaust manifold.
    - Discard the nuts.



60. Remove the LH exhaust manifold heat shield stud bolt.
    - Discard the exhaust manifold gasket.

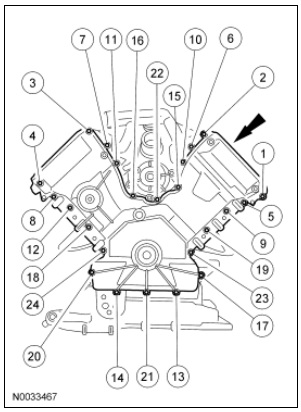


61. Remove the 8 LH exhaust manifold studs and discard.

62. Clean the inspect the LH exhaust manifold. For additional information, refer to Section 303-00 .

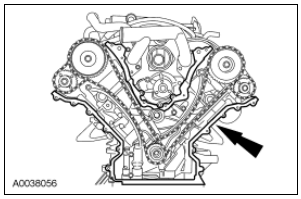
Both sides

63. Remove the engine front cover bolts in the sequence shown.
    - Remove the engine front cover.
    - Discard the gaskets.

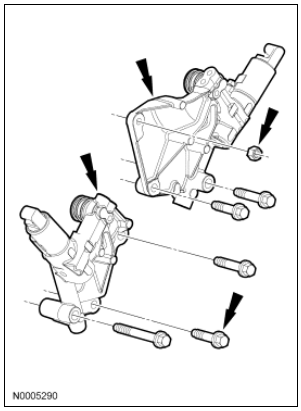


64. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**

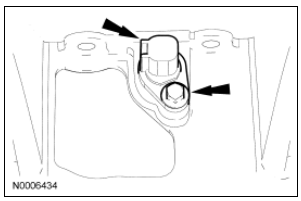
    Clean the sealing surfaces.



65. Remove the RH and LH variable cam timing (VCT) bush carriers.



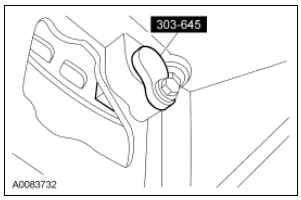
66. Remove the bolt and the CKP sensor.



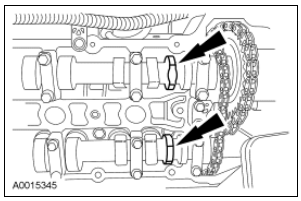
67. **NOTE:** There is one window on the ignition pulse wheel that is unique to accept the special tool.

    Install the special tool.

    - Turn the crankshaft to 45 degrees ATDC. The crankshaft keyway will be in the 6 o'clock position.
    - Install the special tool.

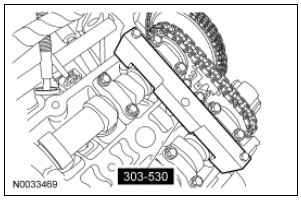


68. Make sure the flats of the camshaft are facing upward. If not, repeat the previous step.



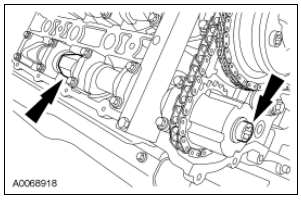
69. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

    Install the special tool on the RH cylinder head.



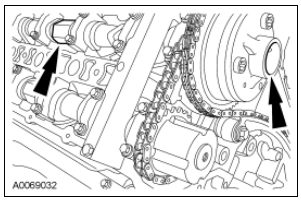
70. ***NOTICE:*** **An open-end wrench must be used on the hex area of the camshaft or damage to the head will occur.**

    Remove and discard the exhaust camshaft sprocket bolt.

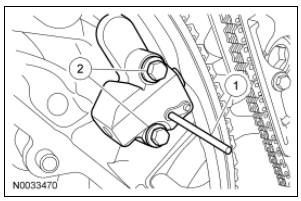


71. ***NOTICE:*** **An open-end wrench must be used on the hex area of the camshaft or damage to the head will occur.**

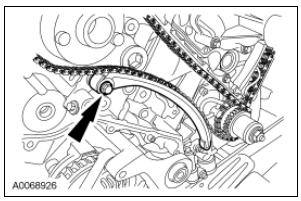
    Remove and discard the VCT unit bolt.



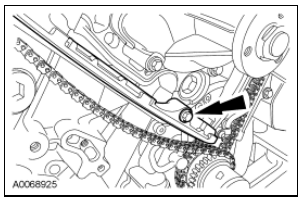
72. Remove the RH timing chain tensioner.
    1. Push the lever down and install a drill rod to lock the piston.
    2. Remove the 2 bolts and the tensioner.



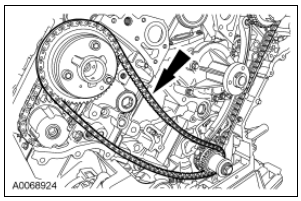
73. Remove the bolt and the RH tensioner arm.



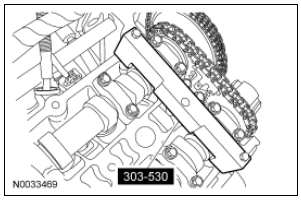
74. Remove the bolt and the RH timing chain guide.



75. Remove the RH primary timing chain.

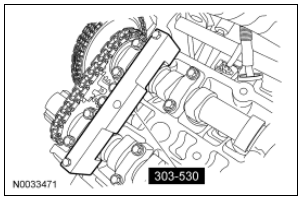


76. Remove the special tool from the RH cylinder head.



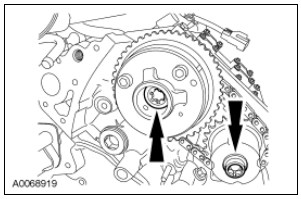
77. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

    Install the special tool on the LH cylinder head.

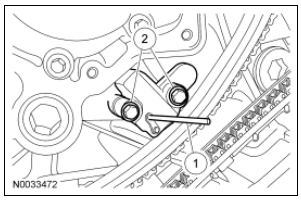


78. ***NOTICE:*** **An open-end wrench must be used on the hex area of the camshaft or damage to the cylinder head will occur.**

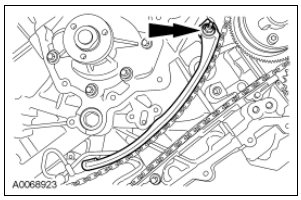
    Remove and discard the LH VCT unit bolt and the exhaust camshaft sprocket bolt.



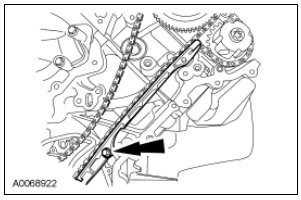
79. Remove the LH timing chain tensioner.
    1. Push the lever down and install a drill rod to lock the piston.
    2. Remove the 2 bolts and the tensioner.



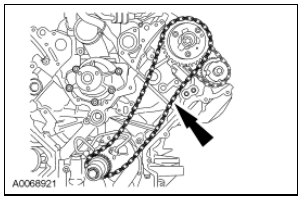
80. Remove the nut and the LH tensioner arm.



81. Remove the bolt and the LH timing chain guide.

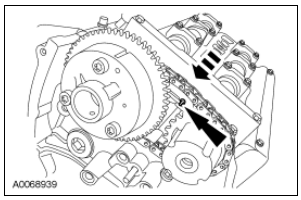


82. Remove the LH primary timing chain.

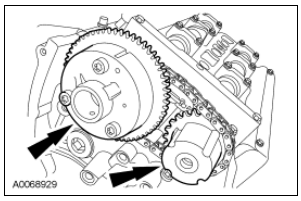


83. Remove the crankshaft sprocket.

84. Collapse the LH secondary timing chain tensioner and install a pin to lock the piston.

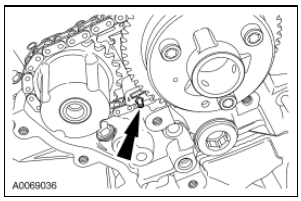


85. Remove the LH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.

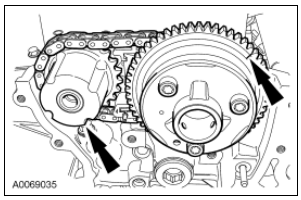


86. Remove the 2 bolts and the LH secondary timing chain tensioner.

87. Collapse the RH secondary timing chain tensioner and install a pin to lock the piston.

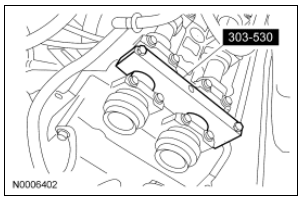


88. Remove the RH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.



89. Remove the 2 bolts and the RH secondary timing chain tensioner.

90. Remove the special tool.

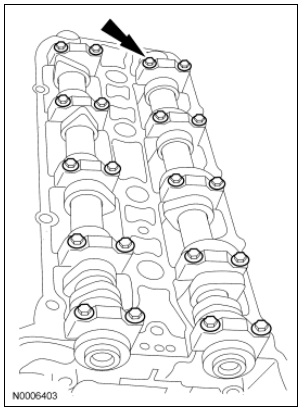


LH side

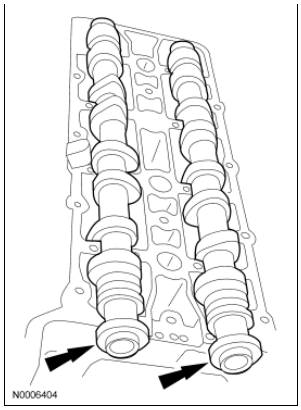
91. ***NOTICE:*** **Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

    Remove the LH camshaft bearing caps.

    - Remove the bolts.
    - Remove the LH camshaft bearing caps.



92. Remove the LH camshafts.



93. ***NOTICE:*** **Do not use any means of marking the shims other than a permanent-type marker. Any scratches or paint on the shims can result in incorrect lash adjustments and severe engine damage.**

    NOTICE: **Record the shim and bucket tappet location. The shim and bucket tappet are positional and if installed in the incorrect location, engine damage can occur.**

    Record the location of the valve tappets.

    - Remove the valve tappets.

94. ***NOTICE:*** **The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.**

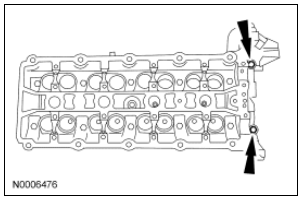
    NOTICE: **Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.**

NOTICE: **The cylinder head bolts must be discarded and new bolts installed. They are tighten-to-yield designed and cannot be reused.**

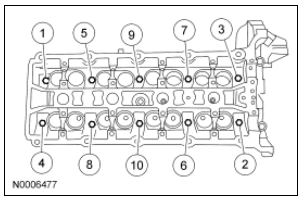
NOTICE: **Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.**

Remove the LH cylinder head end bolts.

- Discard the bolts.



95. Remove and discard the bolts from LH cylinder head in the sequence shown.
    - Remove the cylinder head.
    - Discard the gasket.

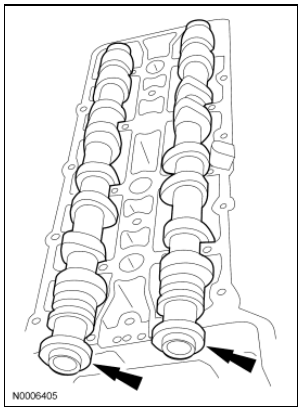


RH side

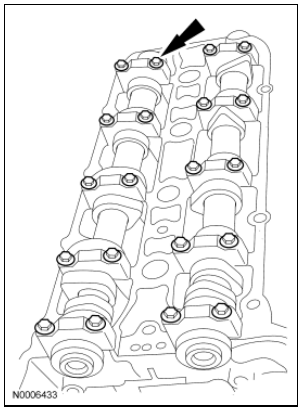
96. ***NOTICE:*** **Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

    Remove the RH camshaft bearing caps.

    - Remove the bolts.
    - Remove the RH camshaft bearing caps.



97. Remove the RH camshafts.



98. ***NOTICE:*** **Do not use any means of marking the shims other than a permanent-type marker. Any scratches or paint on the shims can result in incorrect lash adjustments and severe engine damage.**

    NOTICE: **Record the shim and bucket tappet location. The shim and bucket tappet are positional and if installed in the incorrect location, engine damage can occur.**

    Record the location of the valve tappets.

    - Remove the valve tappets.

99. ***NOTICE:*** **The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.**

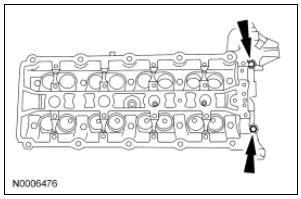
    NOTICE: **Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.**

    NOTICE: **The cylinder head bolts must be discarded and new bolts installed. They are tighten-to-yield designed and cannot be reused.**

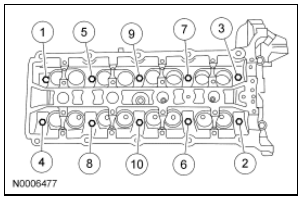
    NOTICE: **Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.**

    Remove the RH cylinder head end bolts.

    - Discard the bolts.



100. Remove and discard the bolts from the RH cylinder head in the sequence shown.
    - Remove the cylinder head.
    - Discard the gasket.



Both sides

101. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**

     NOTICE: **Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.**

     NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

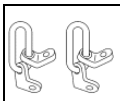
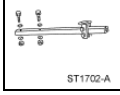
     Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder heads and the cylinder block.

     1. Remove any large deposits of silicone or gasket material with a plastic scraper.
     2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
     3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
     4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant, and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

102. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to Section 303-00 .

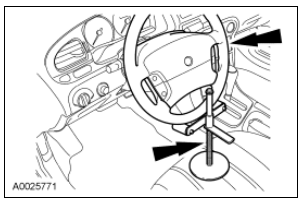
Engine

Special Tool(s)

 ST1595-A	Lifting Brackets, Engine 303-050 (T70P-6000)
ST1602-A	Spreader Bar 303-D089 (D93P-6001-A3)
ST1293-A	Powertrain Lift With Tilting Plate 014-00765
 ST1702-A	Transmission Support Bracket 014-00341

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Hold the steering wheel in the straight ahead position using a suitable holding device.

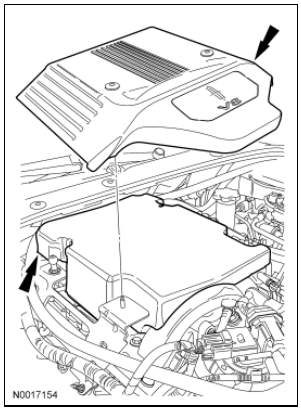

A0025771

3. Release the fuel system pressure. For additional information, refer to Section 310-00 .

4. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

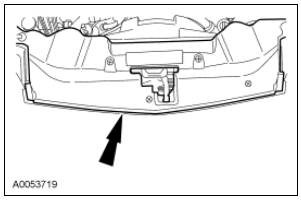
5. ⚠ **CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Remove the engine appearance cover and the noise suppressor (if detached).



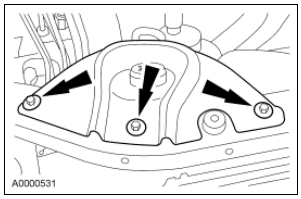
6. Remove the air cleaner assembly and outlet pipe. For additional information, refer to Section 303-12 .
7. ⚠ **CAUTION: The coolant drain procedure must be followed exactly or damage to the engine can occur.**

   Drain the engine cooling system. For additional information, refer to Section 303-03 .
8. Discharge the A/C system. For additional information, refer to Section 412-00 .
9. Remove the fresh air inlet duct. For additional information, refer to Section 412-01 .
10. Disconnect the fuel supply tube. For additional information, refer to Section 310-00 .
11. Remove the upper radiator sight shield.



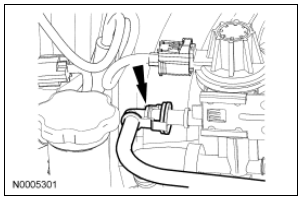
12. **NOTE:** RH shown, LH similar.

    Remove the 6 bolts and the 2 upper radiator support brackets.

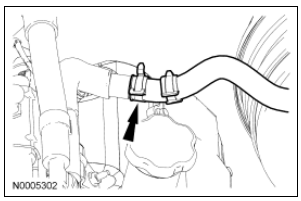


13. ⚠ **CAUTION: To disconnect the quick release coupling, squeeze the tabs and pull straight out or damage to the coupling can occur.**

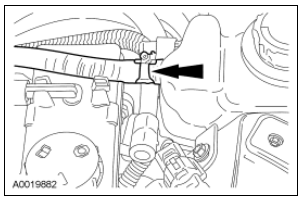
    Disconnect the evaporative emissions (EVAP) hose from the EVAP canister purge valve.



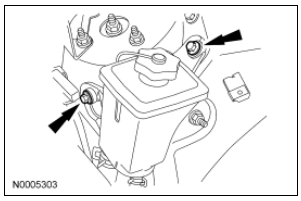
14. Disconnect the vacuum hose.



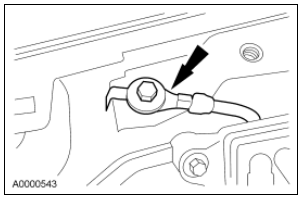
15. Disconnect the degas bottle hose.



16. Remove the 2 power steering reservoir bolts.

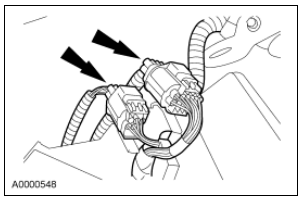


17. Remove the bolt and disconnect the ground strap.

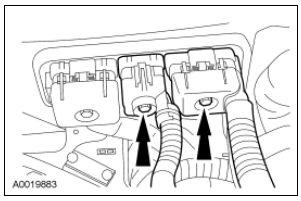


18. **NOTE:** The connectors are located on the backside of the RH strut tower.

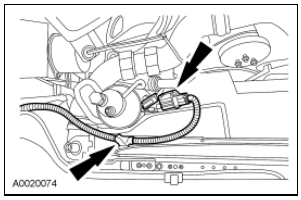
    Disconnect the engine wiring harness electrical connectors.



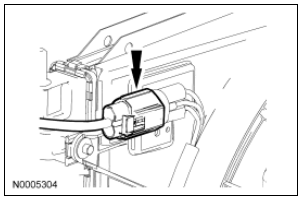
19. Disconnect the bulkhead electrical connectors.



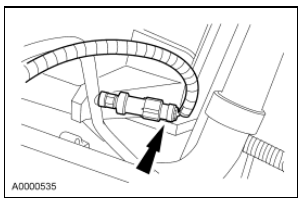
20. Disconnect the coolant valve electrical connector, unclip from the radiator support and position the harness aside.



21. Disconnect the cooling fan electrical connector.

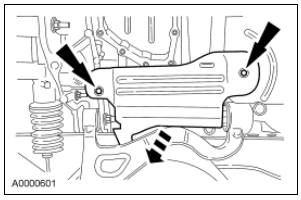


22. Disconnect the A/C pressure switch electrical connector.

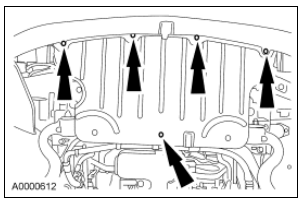


23. **NOTE:** LH shown, RH similar.

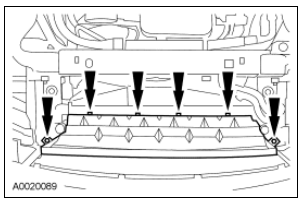
    Remove the LH and the RH splash shields.



24. Remove the center splash shield.



25. Remove the inner air deflector.



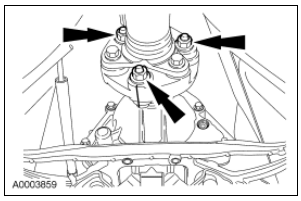
26. Remove the catalytic converters. For additional information, refer to Section 309-00 .

27. ⚠ **CAUTION: To make sure assembly will be in the exact location as when removed, index-mark the bolt, nut, washer and flex coupling to the pinion flange with paint or marker.**

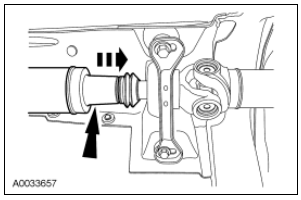
Using a different color paint or marker, index-mark the second bolt, nut, washer and flex coupling to the pinion flange. These fasteners are balanced weights. Always assemble them in their original positions. Failure to do so can cause driveshaft noise, vibration and harshness (NVH).

⚠ CAUTION: Do not remove the bolts retaining the flex coupling to the driveshaft.

Index-mark the front driveshaft pinion flange. Remove the 3 nuts, washers and bolts.



28. Slide the front shaft assembly rearward and support.

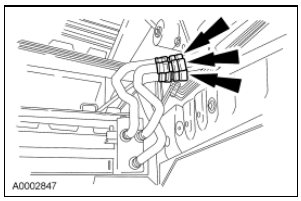


29. Drain the engine oil.
    - Tighten drain plug to 23 Nm (17 lb-ft).

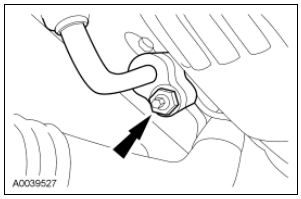
30. **NOTE:** The top heater hose has a green identifying mark to match the hose on the dual coolant flow valve. If the mark is not visible, identify the hoses for location. This will aid in the correct installation of the hose assemblies.

    NOTE: Hose assemblies shown with components removed for clarity.

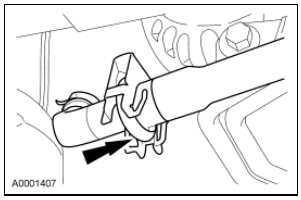
    Disconnect the 3 heater hose quick release couplings. For additional information, refer to Section 412-00 .



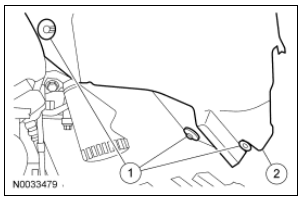
31. Remove the nut and disconnect the A/C high pressure hose.



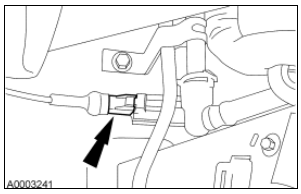
32. Disconnect the low pressure A/C hose.



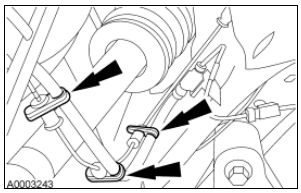
33. Position the RH and LH inner splash shields aside.
    1. Remove the pin-type retainers.
    2. Position the inner splash shields aside.



34. Disconnect the RH and LH anti-lock brake sensor electrical connectors.



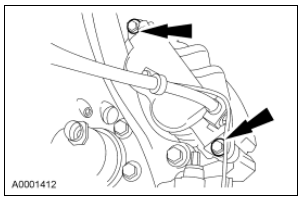
35. Detach the RH and LH anti-lock brake sensor harnesses from the brake hose clips.



36. ⚠ **CAUTION: Do not allow the brake caliper to hang from the brake hose or damage to the brake hose can occur.**

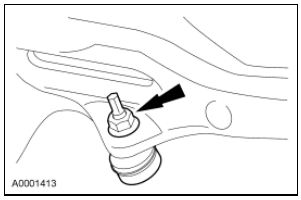
    Remove the 4 bolts and position the front brake calipers aside.

    - Support the calipers using mechanic's wire.



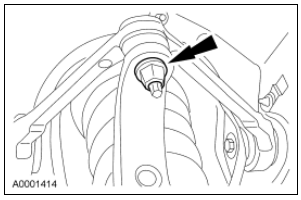
37. **NOTE:** To remove the nut, first loosen the nut, then use the hex-holding feature to prevent the stabilizer bar link ball joint from turning while removing the nut.

    Remove the 2 nuts and disconnect the stabilizer bar links from the lower control arms.

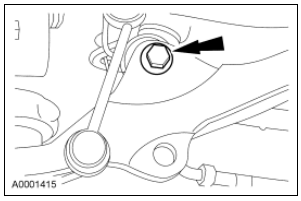


38. **NOTE:** Use the hex-holding feature to prevent the stud from turning while removing the nut from ball joints and stabilizer bar links.

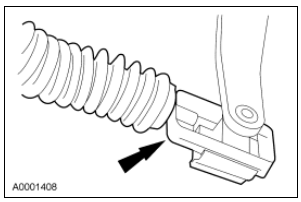
    Remove the 2 nuts and disconnect the upper ball joints from the wheel knuckles.



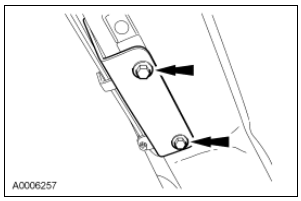
39. Remove the 2 strut-to-control arm bolts and nuts.



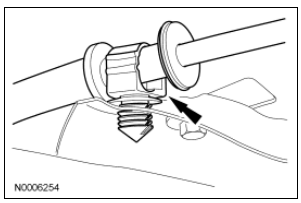
40. Disconnect the shift cable from the shifter.



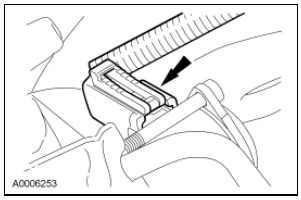
41. Remove the 2 bolts and position the shift cable bracket aside.



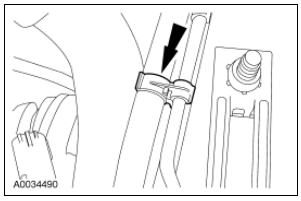
42. Detach the shift cable pin-type retainer from the exhaust heat shield



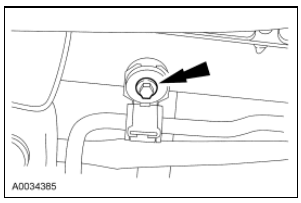
43. Disconnect the variable assist power steering (VAPS) actuator electrical connector.



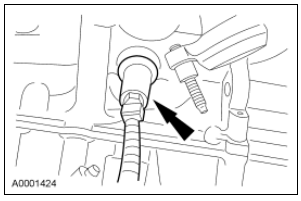
44. Release the power steering return hose from the pressure hose clip.



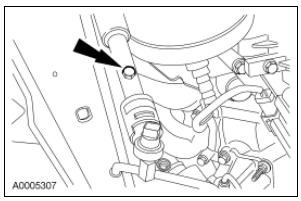
45. Remove the retaining bolt for the high pressure power steering hose bracket.



46. Disconnect the block heater electrical connector, if equipped.

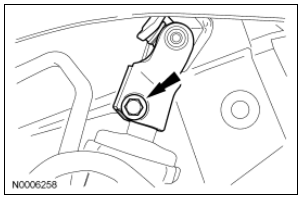


47. Remove the steering shaft bolt.

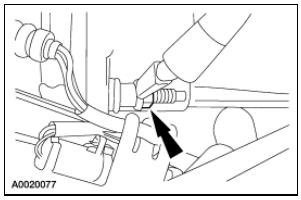


48. **⚠ CAUTION: Do not allow the steering wheel to rotate while the steering column intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the wheel has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

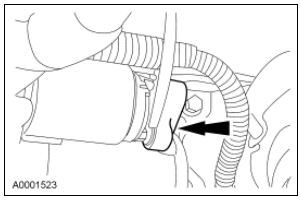
    Remove the bolt and disconnect the steering coupling.



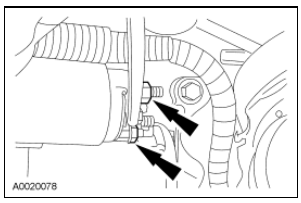
49. Remove the nut and starter motor ground cable.



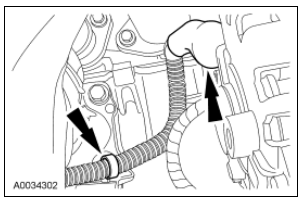
50. Remove the cover.



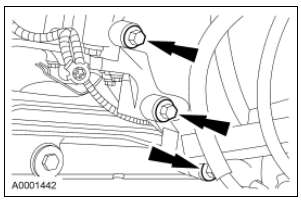
51. Remove the nuts and disconnect the starter motor wiring.



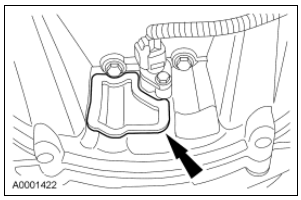
52. Disconnect the generator electrical connector and pin-type retainer.



53. Remove the 6 lower transmission to engine bolts.

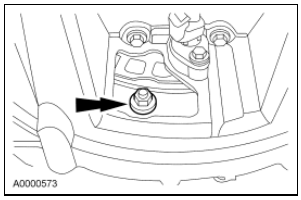


54. Remove the cover.



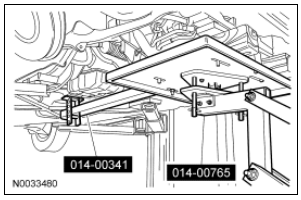
55. **NOTE:** Make an identifying mark on the nut, the stud and adapter plate to allow for correct installation.

    Remove the 4 torque converter nuts.

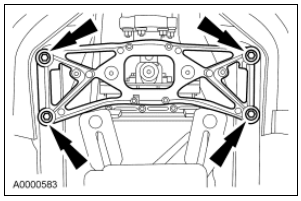


56. Support the rear of the vehicle with suitable safety stands.

57. Support the engine, transmission, front and center crossmembers, and the cooling system with a powertrain lift and a transmission support bracket.

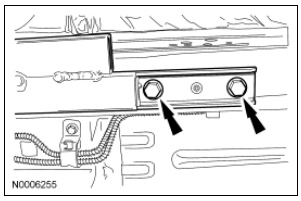


58. Remove the 4 transmission support bolts.



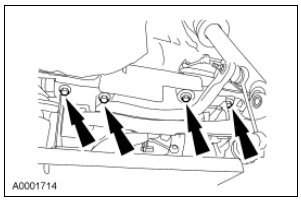
59. **NOTE:** RH shown, LH similar.

    Remove the 4 RH and LH center crossmember I-brace bolts.

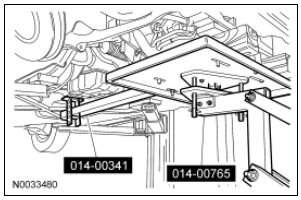


60. **NOTE:** LH shown, RH similar.

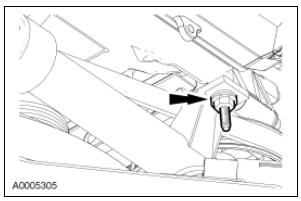
    Remove the 4 front crossmember and the 4 center crossmember bolts.



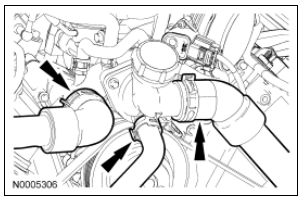
61. Carefully lower the entire assembly from the vehicle.



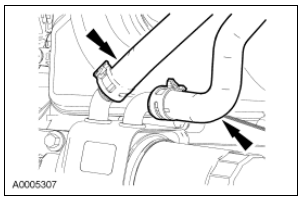
62. Remove the lower radiator hose bracket nut.



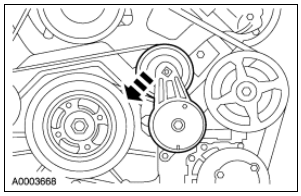
63. Disconnect the lower radiator, upper radiator and heater hose.



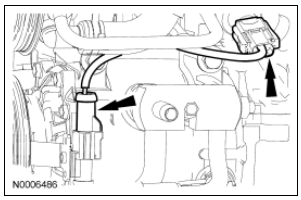
64. Disconnect the 2 oil cooler hoses, if equipped.



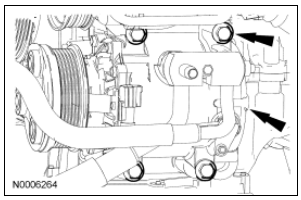
65. Rotate the tensioner and remove the accessory drive belt.



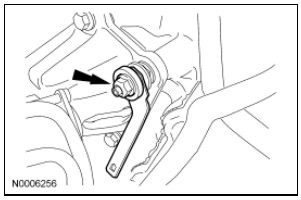
66. Disconnect the A/C compressor and power steering pressure (PSP) switch electrical connectors.



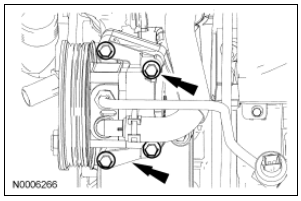
67. Remove the 4 bolts and position the A/C compressor aside.



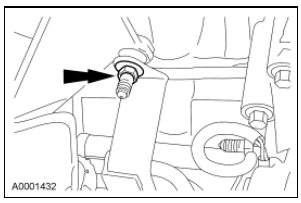
68. Remove the power steering tube bracket nut.



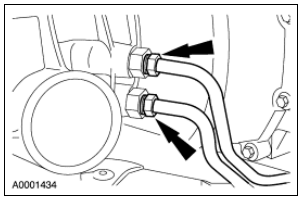
69. Remove the 4 bolts and position aside the power steering pump and reservoir.



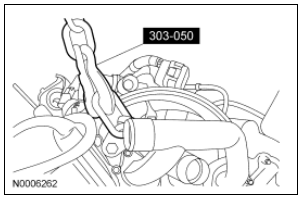
70. Remove the transmission cooler tube bracket nut.



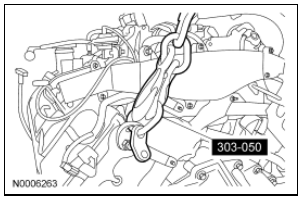
71. Disconnect the transmission cooler tubes.



72. Install the special tool.



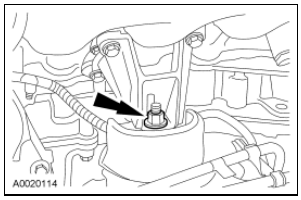
73. Install the special tool.



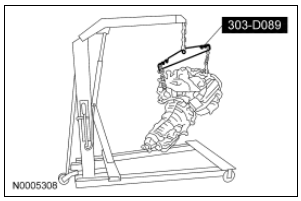
74. Using an engine crane, support the engine and transmission.

75. **NOTE:** LH shown, RH similar.

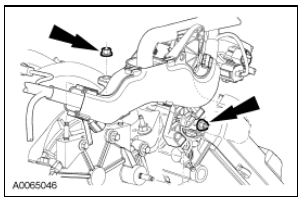
    Remove the LH and the RH upper engine mount nuts.



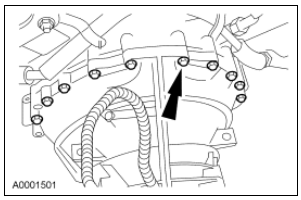
76. Using the special tool and an engine crane, move the engine and transmission from the crossmember and cooling system assembly to rest on the floor or on a bench.



77. Remove the nuts and position the wiring harness aside.

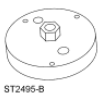
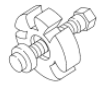


78. Remove the bolts and separate the engine from the transmission.



Engine

Special Tool(s)

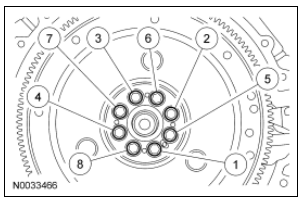
 ST2495-B	Remover/Installer, Crankshaft Rear Oil Seal 303-647
ST2441-A	Adapter for 204-185 204-208 (T95T-5310-AR2)
ST1438-A	Strap Wrench 303-D055
 ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
ST1385-A	Remover, Oil Seal 303-409 (T92C-6700-CH)
ST2398-B	Aligner, Camshaft 303-530

Material

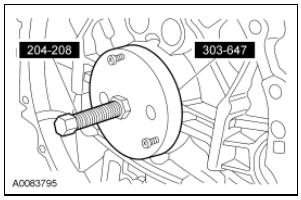
Item	Specification
Silicone Gasket Remover ZC-30	—
Motorcraft Metal Surface Prep ZC-31	—

NOTE: For additional information, refer to the exploded views under the engine assembly procedure in this section.

1. Remove the bolts in the sequence shown.
   - Remove the flexplate.



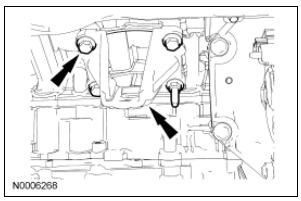
2. Using the special tools, remove the rear main seal.
   - Discard the seal.



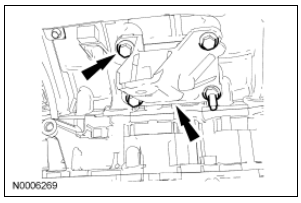
3. Install the engine on a suitable engine stand.

4. Remove the engine block plug to drain the engine coolant.

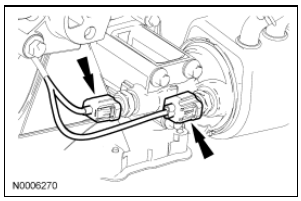
5. Remove the 3 bolts, the stud bolt and the RH engine mount bracket.



6. Remove the 3 bolts, the stud bolt and the LH engine mount bracket.



7. Disconnect the oil pressure and oil temperature sensor electrical connectors.

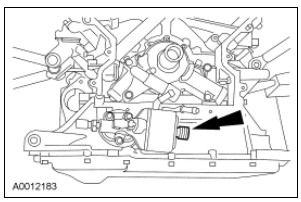


8. Remove and discard the oil filter.

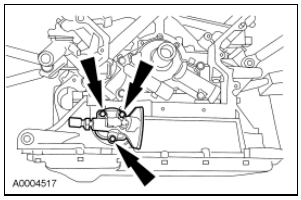
9. ***NOTICE:*** **A new oil cooler must be installed or severe damage to the engine can occur.**

   Remove the bolt and oil cooler.

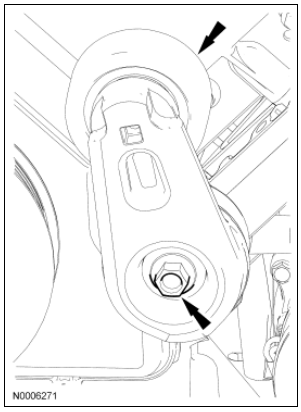
   - Discard the oil cooler and gasket.



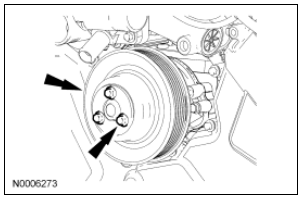
10. Remove the 3 bolts and the oil filter adapter.
    - Discard the O-ring seals.



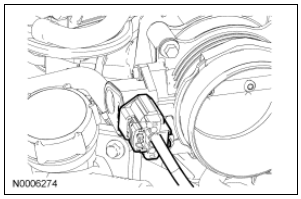
11. Remove the bolt and the accessory drive belt tensioner.



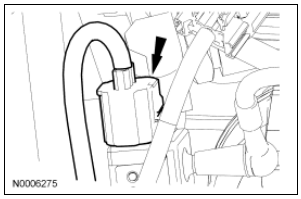
12. Remove the 3 bolts and the coolant pump pulley.



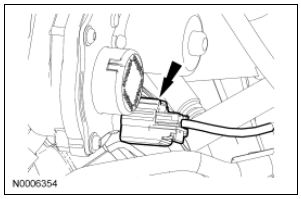
13. Disconnect the throttle position (TP) sensor electrical connector.



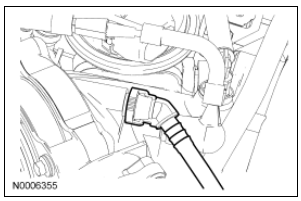
14. Disconnect the fuel pressure sensor electrical connector.



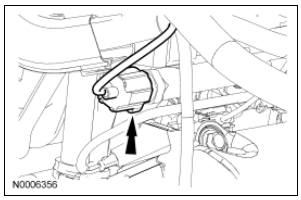
15. Disconnect the electronic throttle body electrical connector.



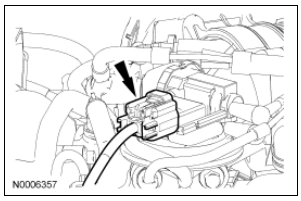
16. Disconnect the evaporative emissions (EVAP) tube.



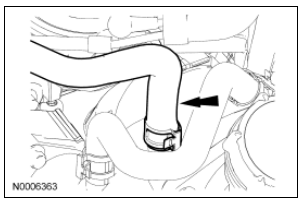
17. Disconnect the fuel rail temperature sensor electrical connector.



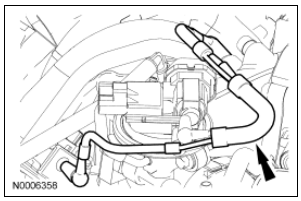
18. Disconnect the exhaust gas recirculation (EGR) system module electrical connector.



19. Disconnect the coolant vent hose from the coolant outlet.
    - Remove the coolant vent hose.



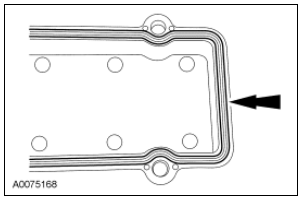
20. Remove the vacuum harness.



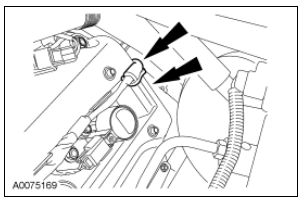
21. **NOTE:** LH shown, RH similar.

    Remove the LH and RH ignition coil covers.

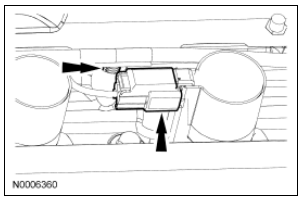
22. Remove all silicone sealer and residue from the ignition coil covers.



23. Remove all silicone sealer and residue from the valve cover surface and ignition coil wiring harness.

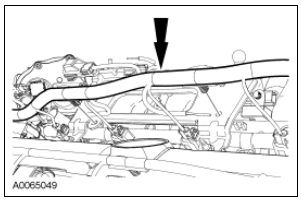


24. Disconnect the 8 ignition coil electrical connectors.

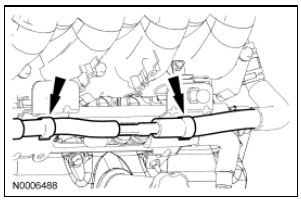


25. **NOTE:** LH shown, RH similar.

Disconnect the engine wiring harness retainers from the engine appearance cover support brackets.

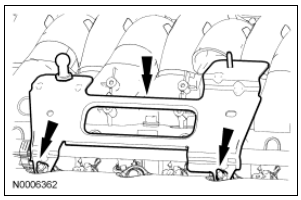


26. Detach the vacuum hose retainers from the LH engine appearance cover support bracket.



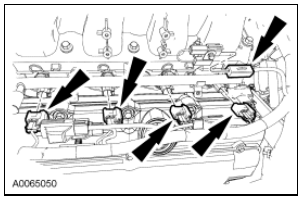
27. **NOTE:** RH shown, LH similar.

Remove the 4 nuts and the 2 engine appearance cover brackets.

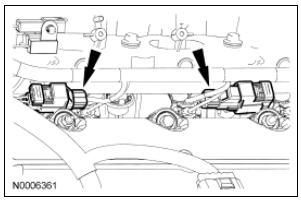


28. **NOTE:** LH shown, RH similar.

Disconnect the 8 fuel injector and the 2 radio interference capacitor electrical connectors.

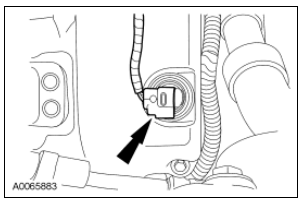


29. Disconnect the knock sensor (KS) and camshaft position (CMP) senor electrical connectors.
    - Detach the pin-type retainers.

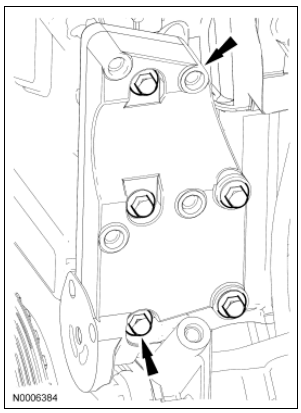


30. **NOTE:** RH shown, LH similar.

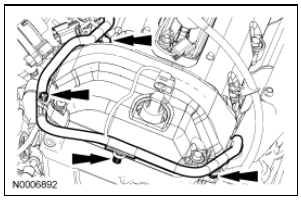
    Disconnect the 2 variable cam timing (VCT) sensor electrical connectors.



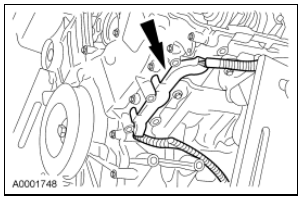
31. Remove the 5 bolts and the power steering bracket.



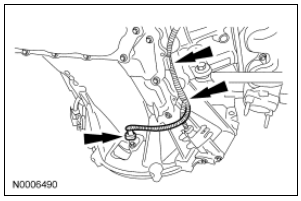
32. Disconnect the wiring harness retainers from the LH valve cover.



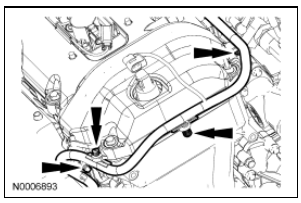
33. Detach the wiring harness from the front cover.



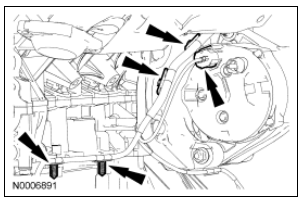
34. Disconnect the crankshaft position (CKP) sensor electrical connector and wiring harness retainers.



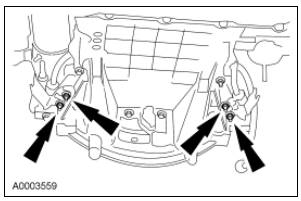
35. Disconnect the wiring harness retainers from the RH valve cover.



36. Disconnect the generator electrical connector and wiring harness retainers.

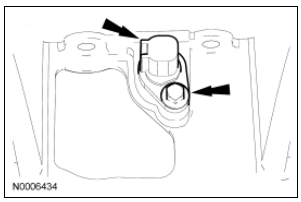


37. Remove the heated oxygen sensor (HO2S) electrical connectors from the brackets.

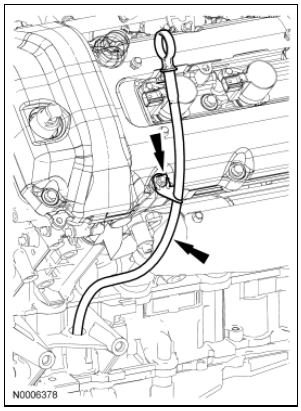


38. Remove the engine wiring harness from the engine.

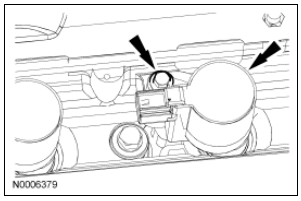
39. Remove the bolt and the CKP sensor.



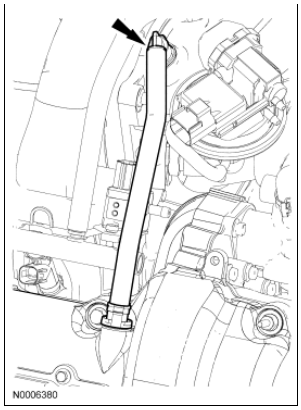
40. Remove the nut and the oil level indicator tube.
    - Discard the O-ring seal.



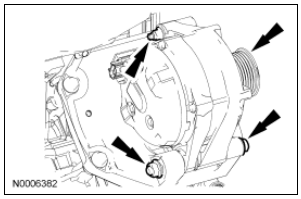
41. Remove the 8 bolts and ignition coils.



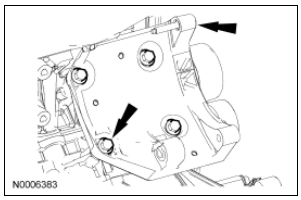
42. Remove the crankcase vent tube.



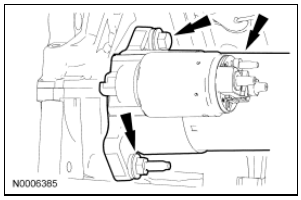
43. Remove the bolt, the 2 nuts and the generator.



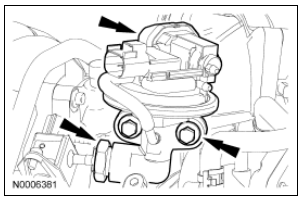
44. Remove the 4 bolts and the generator bracket.



45. Remove the 2 bolts and the starter motor.

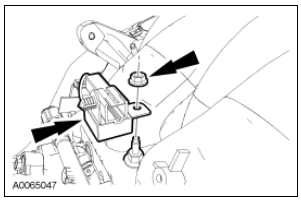


46. Remove the 2 EGR system module bolts and loosen the EGR tube nut.
    - Remove the EGR system module.
    - Discard the gasket.

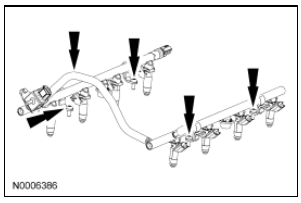


47. **NOTE:** RH shown, LH similar.

    Remove the 2 nuts and the 2 radio interference capacitors.

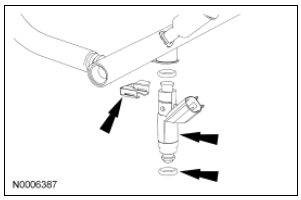


48. Remove the 4 bolts and the fuel rail with fuel injector assembly.

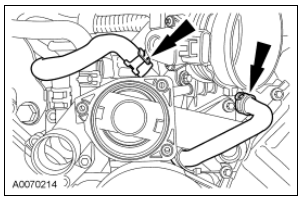


49. **NOTE:** Remove and discard the 16 O-ring seals from the fuel injectors.

    Remove the clips and the 8 fuel injectors from the fuel rail.



50. Disconnect the 2 throttle body coolant hoses.

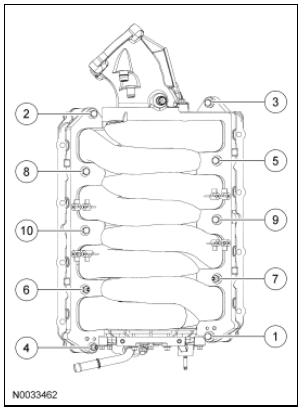


51. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

    NOTE: The throttle body and adapter are shown removed for clarity. It is not necessary to remove the throttle body and adapter to remove the intake manifold.

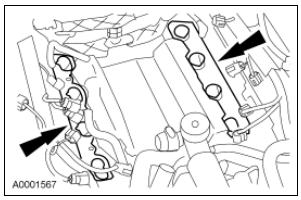
    Remove the 7 bolts and 3 studs in the sequence shown.

    - Remove the intake manifold.
    - Discard the gaskets.

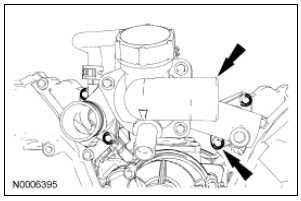


52. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to clean the surfaces.**

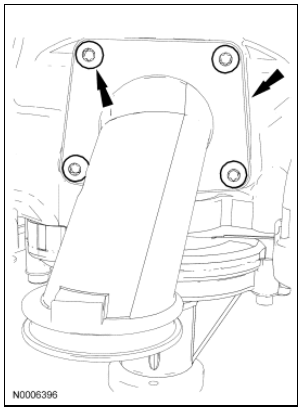
    Clean the sealing surfaces.



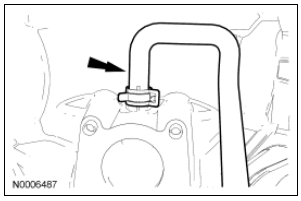
53. Remove the 4 bolts and the coolant bypass housing.
    - Discard the O-ring seals.



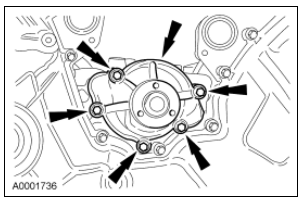
54. Remove the 4 bolts and the coolant inlet housing.
    - Discard the O-ring seal.



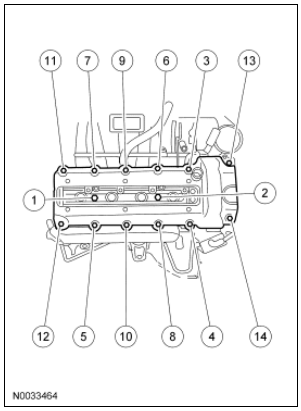
55. Remove the throttle body coolant hose.



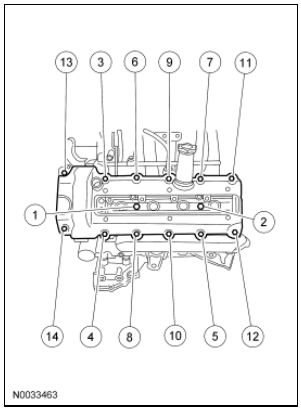
56. Remove the 5 bolts and the coolant pump.
    - Discard the gasket.



57. Remove the bolts in the sequence shown and remove the RH valve cover.
    - Discard the gasket.

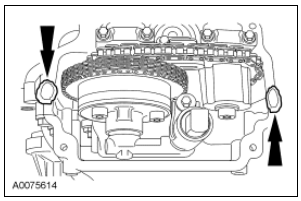


58. Remove the bolts in the sequence shown and remove the LH valve cover.
    - Discard the gasket.

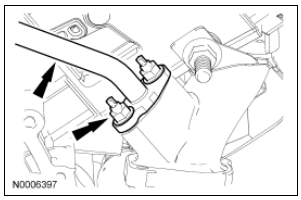


59. *NOTICE:* **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to clean the surfaces.**

    Remove the gaskets and all silicone sealer. Clean the mating surfaces with silicone gasket remover.

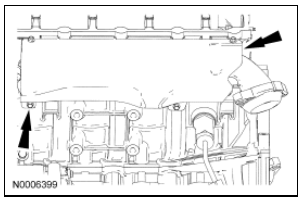


60. Remove the 2 nuts and the EGR tube.
    - Discard the gasket.



61. **NOTE:** LH shown, RH similar.

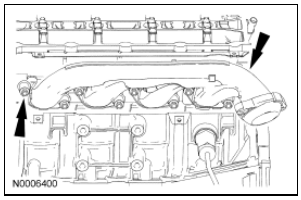
    Remove the 8 bolts and the 2 exhaust manifold heat shields.



62. **NOTE:** LH shown, RH similar.

    Remove the nuts and exhaust manifolds.

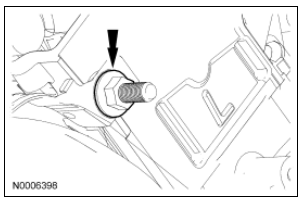
    - Discard the nuts.



63. **NOTE:** LH shown, RH similar.

    Remove the 2 exhaust manifold heat shield stud bolts.

    - Discard the 2 exhaust manifold gaskets.

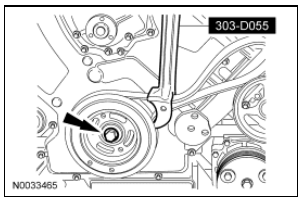


64. Remove the 16 exhaust manifold studs and discard.

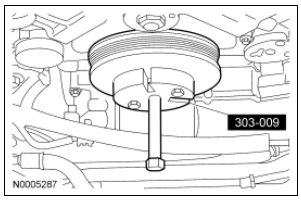
65. Clean and inspect the exhaust manifolds. For additional information, refer to Section 303-00 .

66. **NOTE:** Hold the crankshaft pulley with the special tool while removing the bolt and washer.

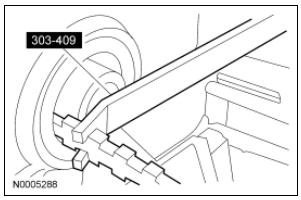
    Remove and discard the bolt and washer.



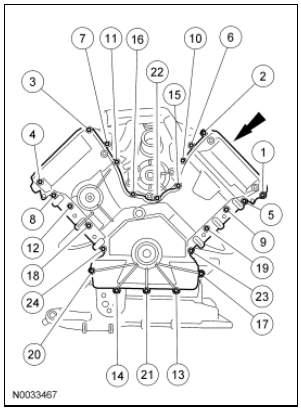
67. Using the special tool, remove the crankshaft damper.



68. Using the special tool, remove and discard the front crankshaft seal.

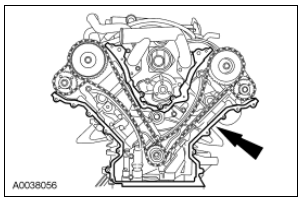


69. Remove the engine front cover bolts in the sequence shown.
    - Remove the engine front cover.
    - Discard the gaskets.

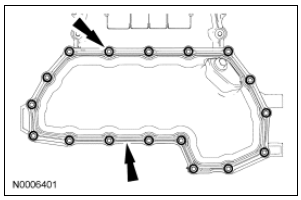


70. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**

    Clean the sealing surfaces.

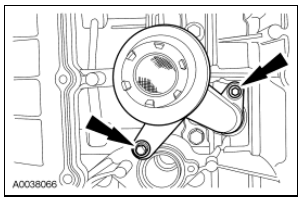


71. Remove the 17 bolts and the oil pan.
    - Discard the gasket.

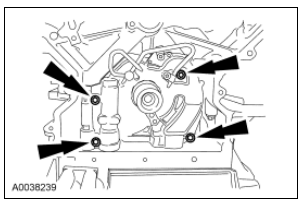


72. ***NOTICE:*** **Use only hand tools to remove the oil pump screen and tube.**

    Remove the oil pump screen and tube, and the seal.



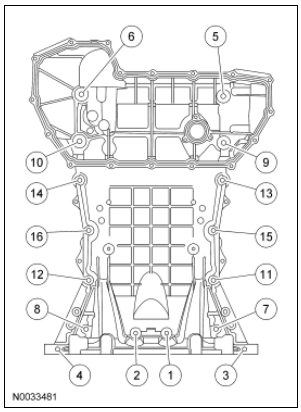
73. Remove the 4 bolts and the oil pump.



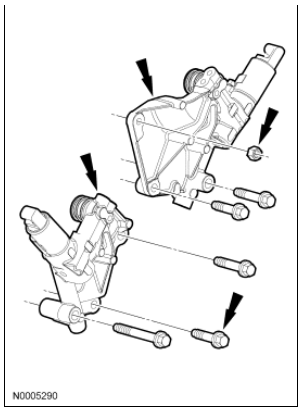
74. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive**

means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of the sealant.

Remove the bolts in the sequence shown and remove the sump body.

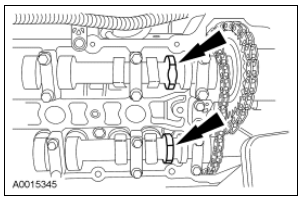


75. Remove the RH and LH VCT bush carriers.



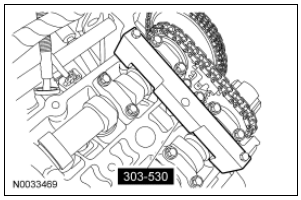
76. Turn the crankshaft to 45 degrees ATDC. The crankshaft keyway will be in the 6 o'clock position.

77. Make sure the flats of the camshaft are facing upward. If not, repeat the previous step.



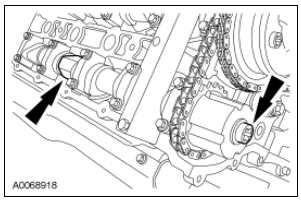
78. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

Install the special tool on the RH cylinder head.



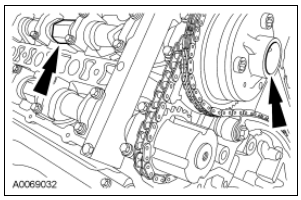
79. ***NOTICE:*** **An open-end wrench must be used on the hex area of the camshaft or damage to the head will occur.**

    Remove and discard the exhaust camshaft sprocket bolt.

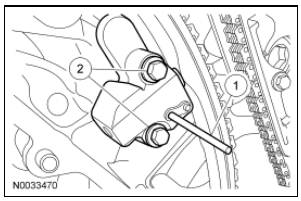


80. ***NOTICE:*** **An open-end wrench must be used on the hex area of the camshaft or damage to the head will occur.**

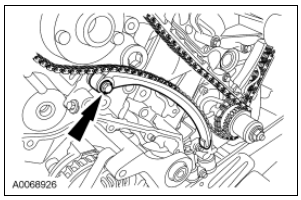
    Remove and discard the VCT unit bolt.



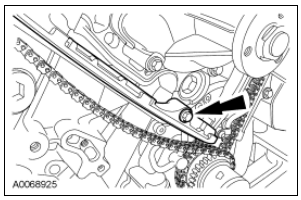
81. Remove the RH timing chain tensioner.
    1. Push the lever down and install a drill rod to lock the piston.
    2. Remove the bolts and the tensioner.



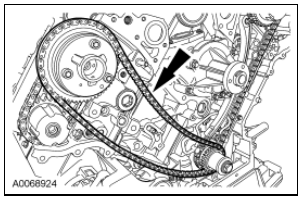
82. Remove the bolt and the RH tensioner arm.



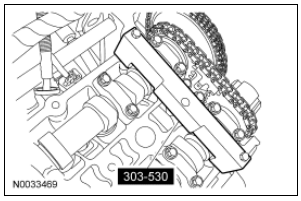
83. Remove the bolt and the RH timing chain guide.



84. Remove the RH primary timing chain.

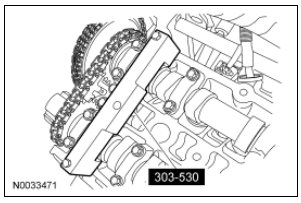


85. Remove the special tool from the RH cylinder head.



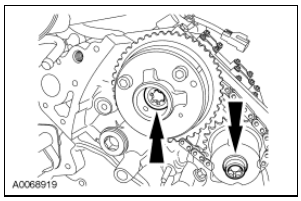
86. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

    Install the special tool on the LH cylinder head.

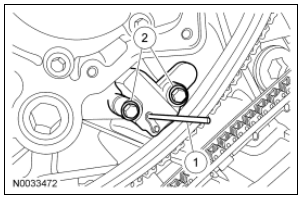


87. ***NOTICE:*** **An open-end wrench must be used on the hex area of the camshaft or damage to the cylinder head will occur.**

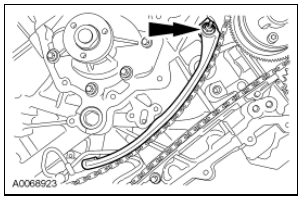
    Remove and discard the LH VCT unit bolt and the exhaust camshaft sprocket bolt.



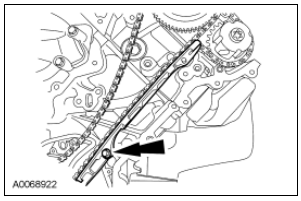
88. Remove the LH timing chain tensioner.
    1. Push the lever down and install a drill rod to lock the piston.
    2. Remove the 2 bolts and the tensioner.



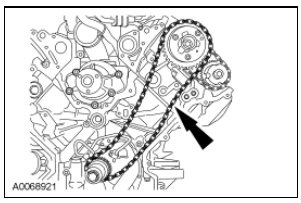
89. Remove the nut and the LH tensioner arm.



90. Remove the bolt and the LH timing chain guide.

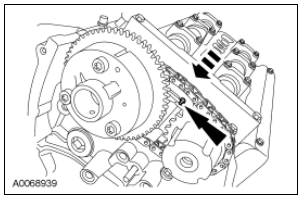


91. Remove the LH primary timing chain.

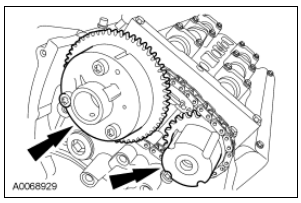


92. Remove the crankshaft sprocket.

93. Collapse the LH secondary timing chain tensioner and install a pin to lock the piston.

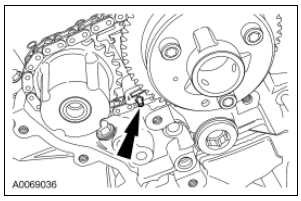


94. Remove the LH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.

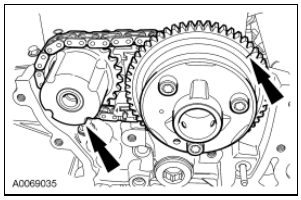


95. Remove the 2 bolts and the LH secondary timing chain tensioner.

96. Collapse the RH secondary timing chain tensioner and install a pin to lock the piston.

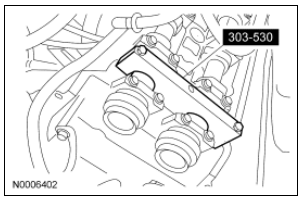


97. Remove the RH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.



98. Remove the 2 bolts and the RH secondary timing chain tensioner.

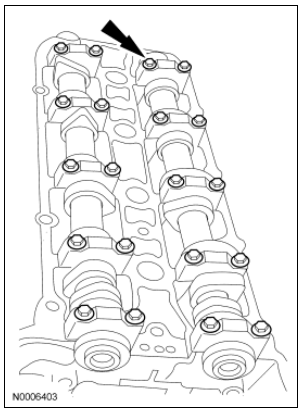
99. Remove the special tool.



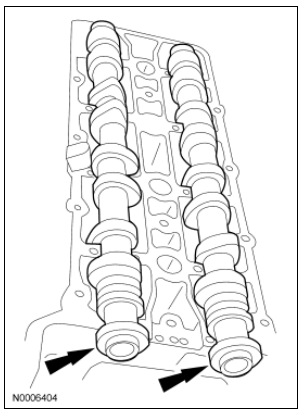
100. ***NOTICE:*** **Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

    Remove the LH camshaft bearing caps.

    - Remove the bolts.
    - Remove the LH camshaft bearing caps.



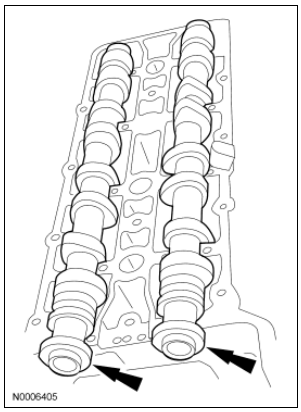
101. Remove the LH camshafts.



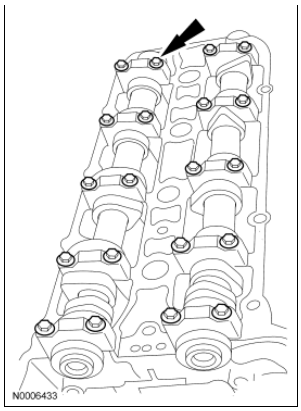
102. ***NOTICE:*** **Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

Remove the RH camshaft bearing caps.

- Remove the bolts.
- Remove the RH camshaft bearing caps.



103. Remove the RH camshafts.



104. ***NOTICE:*** **Do not use any means of marking the shims other than a permanent-type marker. Any scratches or paint on the shims can result in incorrect lash adjustments and severe engine damage.**

NOTICE: **Record the shim and bucket tappet location. The shim and bucket tappet are positional and if installed in the incorrect location, engine damage can occur.**

Record the location of the valve tappets.

- Remove the valve tappets.

105. ***NOTICE:*** **The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.**

NOTICE: **Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.**

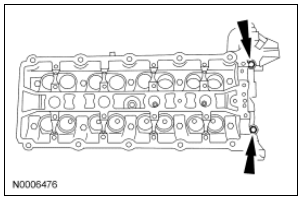
NOTICE: **The cylinder head bolts must be discarded and new bolts installed. They are tighten-to-yield designed and cannot be reused.**

NOTICE: **Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.**

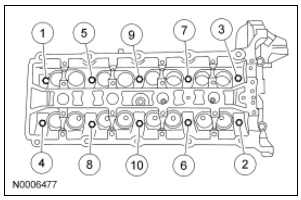
NOTE: RH shown, LH similar.

Remove the RH and LH cylinder head end bolts.

- Discard the bolts.



106. Remove and discard the bolts from both cylinder heads in the sequence shown.
    - Remove the cylinder heads.
    - Discard the gaskets.



107. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**

    NOTICE: **Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.**

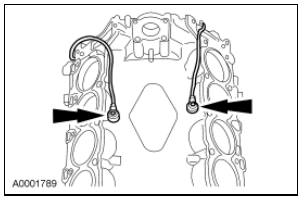
    NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

    Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block.

    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant, and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

108. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to Section 303-00 .

109. Remove the bolts and the knock sensor.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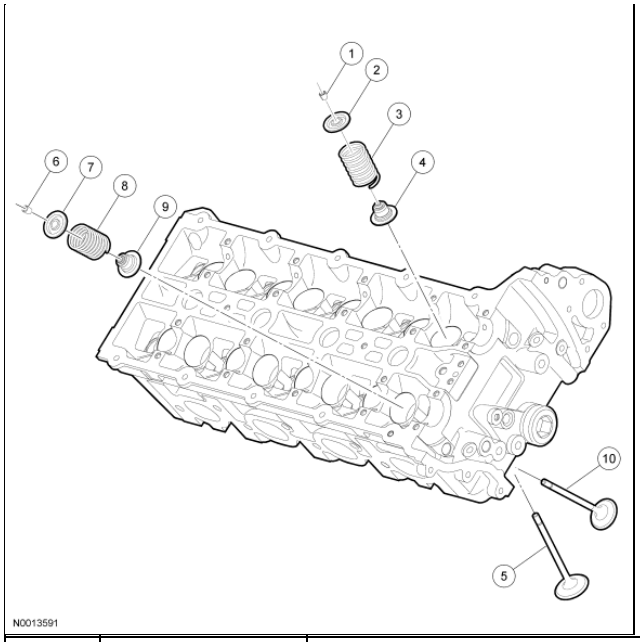
Cylinder Head

Special Tool(s)

ST2489-A	Compressor, Valve Spring 303-648

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

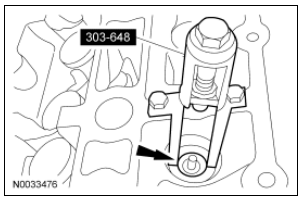


Item	Part Number	Description
1	6518	Intake valve spring retainer key (16 required)
2	2762	Intake valve spring retainer (8 required)
3	6513	Intake valve spring (8 required)
4	6A536	Intake valve stem seal (8 required)
5	6507	Intake valve (8 required)
6	6518	Exhaust valve spring retainer key (16 required)
7	2762	Exhaust valve spring retainer (8 required)
8	6513	Exhaust valve spring (8 required)
9	6A536	Exhaust valve stem seal (8 required)

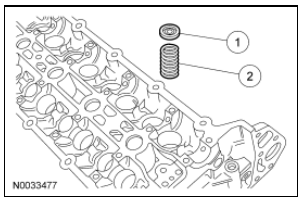
10	6505	Exhaust valve (8 required)

Disassembly

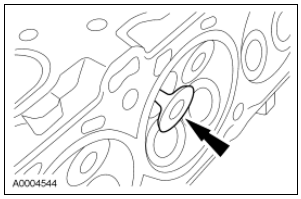
1. Using the special tool, remove the valve spring retainer keys.



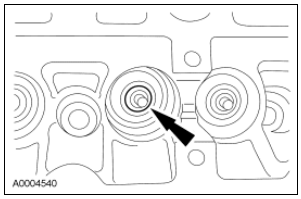
2. Remove the valve spring assembly.
    1. Remove the valve spring retainer.
    2. Remove the valve spring.



3. Remove the valve.
    - For component tests for the valve, refer to Section 303-00 .
    - For component tests for the cylinder head, refer to Section 303-00 .



4. Remove and discard the valve stem seal.



5. Repeat the procedure until all of the valves are removed from the cylinder head.

6. Remove the bolt and the camshaft position (CMP) sensor.

7. Remove and discard the cylinder head temperature (CHT) sensor.

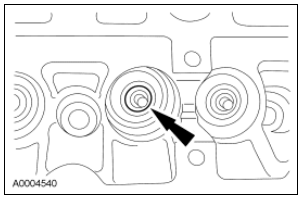
Assembly

1. Install a new CHT sensor.
    - Tighten to 22 Nm (16 lb-ft).

2. Install the CMP sensor and bolt.
    - Tighten to 10 Nm (89 lb-in).

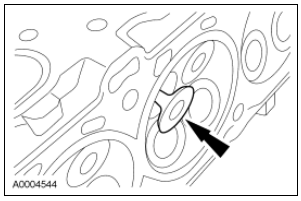
3. **NOTE:** Lubricate the valve stem seal with clean engine oil prior to installation.

   Install the valve stem seal.

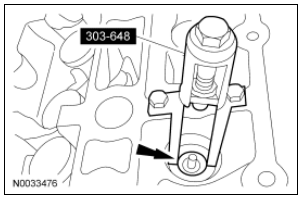


4. **NOTE:** Lubricate the valve stem with clean engine oil prior to installation.

   Install the valve.



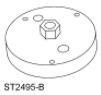
5. Using the special tool, install the valve spring, retainer and retainer keys.



6. Repeat the procedure until all of the valves are installed into the cylinder head.

Engine

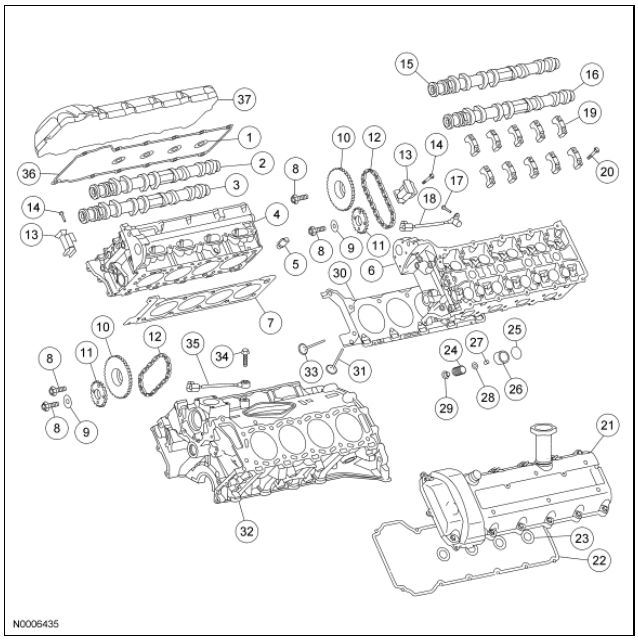
Special Tool(s)

ST2423-A	Installer, Crankshaft Front Oil Seal 303-646
ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
ST2398-B	Aligner, Camshaft 303-530
ST2399-A	Tensioner, Timing Chain 303-532
ST2401-A	Alignment Gauge, Crankshaft 303-645
 ST2495-B	Remover/Installer, Crankshaft Rear Oil Seal 303-647
ST2441-A	Adapter for 204-185 204-208 (T95T-5310-AR2)
ST1595-A	Lifting Brackets, Engine 303-050 (T70P-6000)
ST1602-A	Spreader Bar 303-D089 (D93P-6001-A3)

Material

Item	Specification
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

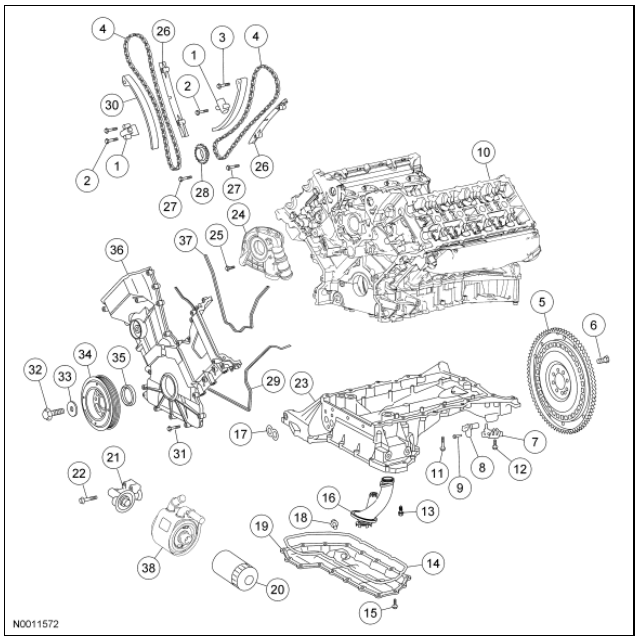
Cylinder Head and Valve Train



Item	Part Number	Description
1	12A409	RH valve cover gaskets (4 required)
2	6A270	RH intake camshaft
3	6A272	RH exhaust camshaft
4	6049	RH cylinder head
5	6G004	Cylinder head temperature (CHT) sensor
6	6050	LH cylinder head
7	6051	RH cylinder head gasket
8	W701512	Bolt (4 required)
9	W704842	Washer (2 required)
10	6256	Intake camshaft sprocket (2 required)
11	6C258	Exhaust camshaft sprocket (2 required)
12	6268	Secondary timing chain (2 required)
13	6B209	Secondary timing chain tensioner
14	W500302	Bolt (4 required)
15	6A271	LH intake camshaft
16	6A273	LH exhaust camshaft
17	W500214	Bolt
18	6B288	Camshaft position (CMP) sensor
19	6A258	Camshaft bearing cap (20 required)
20	W701242	Bolt (40 required)
21	6P053	LH valve cover
22	6P054	LH valve cover gasket
23	12A409	LH valve cover gasket (4 required)
24	6513	Valve spring (32 required)
25	6K514	Valve shim (32 required)
26	6500	Bucket (32 required)

27	6518	Valve keeper key (64 required)
28	2762	Valve keeper (32 required)
29	6A536	Valve seal (32 required)
30	6083	LH cylinder head gasket
31	6507	Intake valve (16 required)
32	6L074	Cylinder block assembly
33	6505	Exhaust valve
34	W500310	Bolt (2 required)
35	12A699	Knock sensor (KS) (2 required)
36	6K260	RH valve cover gasket
37	6P040	RH valve cover

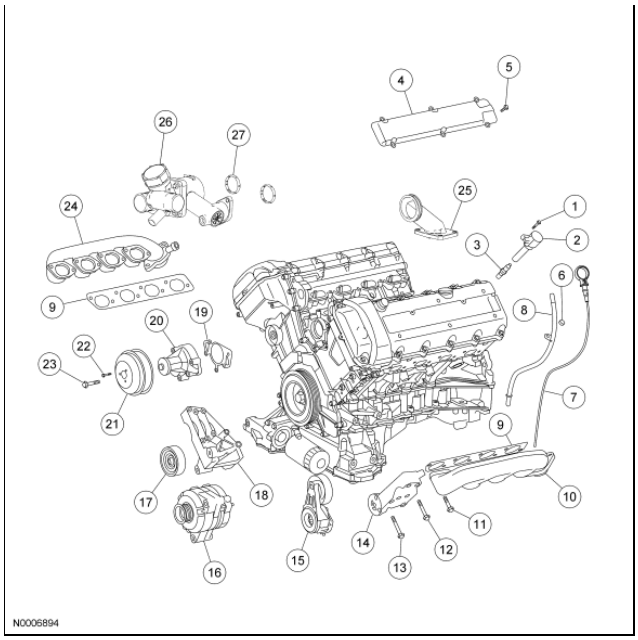
Lower End



Item	Part Number	Description
1	6K254	Primary timing chain tensioner (2 required)
2	W500302	Bolt (4 required)
3	W701973	Bolt (2 required)
4	6268	Primary timing chain (2 required)
5	6K375	Flexplate
6	W704862	Bolt (8 required)
7	14W163	Heated oxygen sensor (HO2S) bracket (2 required)
8	6C315	Crankshaft position (CKP) sensor
9	W500214	Bolt
10	6L074	Cylinder block assembly
11	W704749	Bolt (16 required)
12	W701504	Bolt (2 required)
13	W500305	Bolt (3 required)

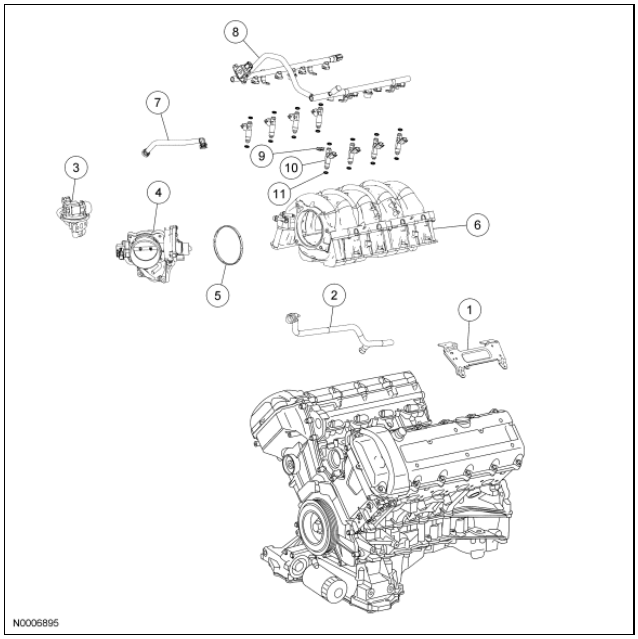
14	6B638	Oil pan gasket
15	W701504	Bolt (17 required)
16	6617	Oil pump screen cover and tube
17	6840	Gasket
18	W704995	Oil drain plug
19	6695	Oil pan assembly
20	6714	Oil filter
21	6A644	Oil filter adapter
22	W704816	Bolt (3 required)
23	6C674	Upper sump assembly
24	6600	Oil pump
25	W500304	Bolt (4 required)
26	6K297	Timing chain guide (2 required)
27	W500302	Bolt (2 required)
28	6306	Crankshaft timing chain sprocket (2 required)
29	6E009	Front cover gasket (outer)
30	6L266	Timing chain tensioner arm
31	W704751	Bolt (24 required)
32	W705542	Bolt
33	W704965	Washer
34	6316	Crankshaft pulley
35	6700	Front cover seal
36	6059	Engine front cover assembly
37	6C075	Front cover seal (inner)
38	6A642	Oil cooler

Lower End Exterior Dress



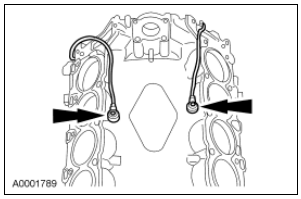
Item	Part Number	Description
1	W500205	Bolt (8 required)
2	12A366	Ignition coil (8 required)
3	12405	Spark plug (8 required)
4	12025	Coil cover (2 required)
5	W500205	Bolt (12 required)
6	W520411	Nut
7	6752	Oil level indicator
8	6754	Oil level indicator tube
9	9448	Exhaust manifold gasket (2 required)
10	9431	Exhaust manifold, LH
11	W701240	Bolt (16 required)
12	W500315	Bolt (3 required)
13	W704752	Bolt (2 required)
14	3K738	Power steering bracket
15	6B209	Drive belt tensioner
16	10300	Generator
17	19A216	Idler pulley, flanged
18	3D743	Generator bracket
19	8507	Coolant pump gasket
20	8501	Coolant pump
21	8509	Coolant pump pulley
22	W705629	Bolt (3 required)
23	W500304	Bolt (5 required)
24	9430	RH exhaust manifold
25	8K515	Coolant inlet
26	8A520	Coolant outlet
27	8255	O-ring seal

Upper End Exterior Dress



Item	Part Number	Description
1	6N081	Engine appearance cover bracket (2 required)
2	9E470	Exhaust gas recirculation (EGR) tube
3	9D460	EGR system module
4	9F991	Electronic throttle body
5	W701662	Electronic throttle body gasket
6	9425	Intake manifold
7	9K617	Crankcase ventilation hose
8	9S441	Fuel rail
9	9N976	Clip (8 required)
10	9F593	Fuel injector (8 required)
11	W705818	O-ring seals (16 required)

1. Install the knock sensors (KS) and 2 bolts.
    - Tighten to 20 Nm (15 lb-ft).



2. Lightly oil the new cylinder head bolts and allow to drain for a few minutes before installing.

3. ***NOTICE:*** **The gasket sealing surfaces on the cylinder head and cylinder block must be clean and dry.**

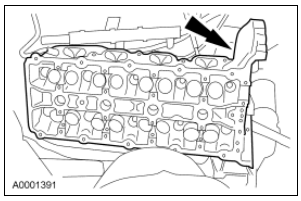
   NOTICE: **The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.**

   NOTICE: **The new gasket has a film coating which is crucial to the gasket's ability to seal correctly. Do not scratch the gasket.**

NOTICE: **Cylinder head machining or milling is not authorized by Ford Motor Company. Cylinder head flatness must be within 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area.**

NOTICE: **Do not allow the dowels to scratch the sealing surface of the cylinder head during cylinder head installation.**

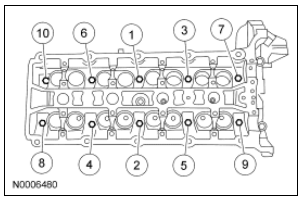
Install new gaskets and position the cylinder heads on the engine.



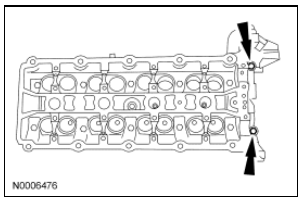
4. **NOTE:** The cylinder head bolts are a torque-to-yield design and must not be reused. Always use new bolts.

   Install and tighten the RH head bolts in 4 stages in the sequence shown.

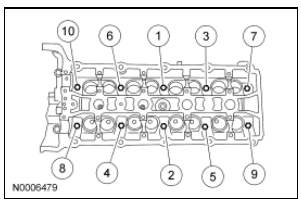
   - Stage 1: Tighten bolts 1 through 10 to 20 Nm (15 lb-ft).
   - Stage 2: Tighten bolts 1 through 10 to 35 Nm (26 lb-ft).
   - Stage 3: Tighten bolts 1 through 10 to 45 Nm (33 lb-ft) and an additional 90 degrees.
   - Stage 4: Tighten bolts 1 through 10 an additional 90 degrees.



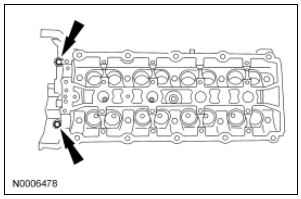
5. Install the 2 bolts and tighten in 2 stages.
   - Stage 1: Tighten to 20 Nm (15 lb-ft).
   - Stage 2: Tighten an additional 90 degrees.



6. Install and tighten the LH head bolts in 4 stages in the sequence shown.
   - Stage 1: Tighten bolts 1 through 10 to 20 Nm (15 lb-ft).
   - Stage 2: Tighten bolts 1 through 10 to 35 Nm (26 lb-ft).
   - Stage 3: Tighten bolts 1 through 10 to 45 Nm (33 lb-ft) and an additional 90 degrees.
   - Stage 4: Tighten bolts 1 through 10 an additional 90 degrees.

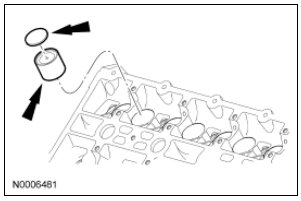


7. Install the 2 bolts and tighten in 2 stages.
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



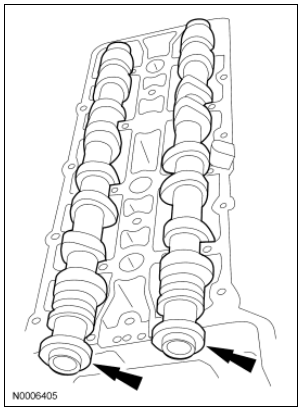
8. **NOTE:** Coat the valve tappets with clean engine oil prior to installing.

   Install the valve tappets and shims in their original location.



9. **NOTE:** Apply clean engine oil to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

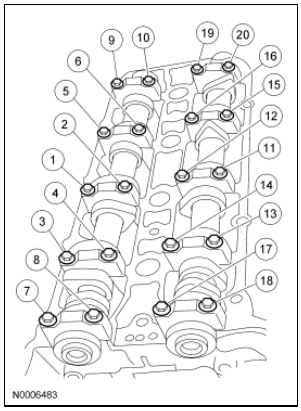
   Position the RH camshafts on the camshaft journals.



10. ***NOTICE:*** **Install the camshaft bearing caps. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

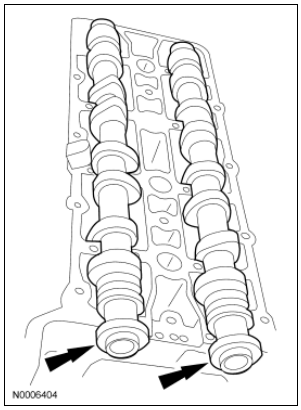
    Install the RH camshaft bearing caps.

    - Position the bearing caps.
    - Install the bearing cap bolts. Tighten the bolts in 3 stages in the sequence shown.
        - ♦ Stage 1: Hand-tighten.
        - ♦ Stage 2: Tighten to 6 Nm (53 lb-in).
        - ♦ Stage 3: Tighten an additional 90 degrees.



11. **NOTE:** Apply clean engine oil to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

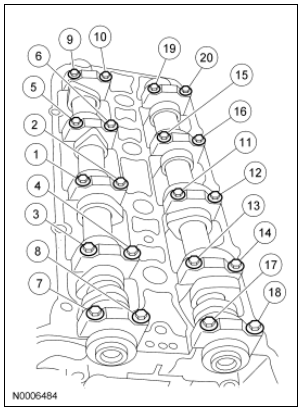
    Position the LH camshafts on the camshaft journals.



12. ***NOTICE:*** **Install the camshaft bearing caps. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

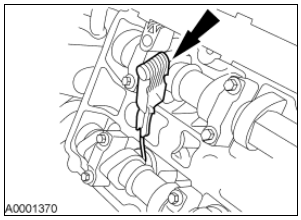
    Install the LH camshaft bearing caps.

    - Position the bearing caps.
    - Install the bearing cap bolts. Tighten the bolts in 3 stages in the sequence shown.
        - ♦ Stage 1: Hand-tighten.
        - ♦ Stage 2: Tighten to 6 Nm (53 lb-in).
        - ♦ Stage 3: Tighten an additional 90 degrees.



13. ***NOTICE:*** **If any components are installed new, the engine must be reshimmed or engine damage can occur.**

    Using a feeler gauge, confirm that the tappet and shim clearances are within specification. For additional information, refer to Valve Clearance Check in this section.



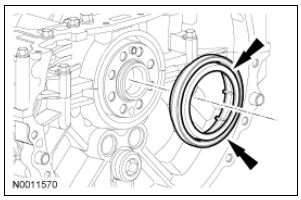
14. If tappet and shim clearances are not within specification, adjust the clearance. For additional information, refer to Valve Clearance Adjustment in this section.

15. Install the engine lifting equipment and remove the engine from the stand.

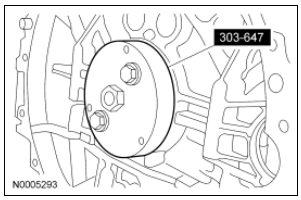
16. ***NOTICE:*** **The plastic sleeve that comes with the new crankshaft rear oil seal protects the seal while in transit and is also used as an installation tool to prevent lip seal roll when carrying out the repair. The sleeve must be used to prevent future seal concerns.**

    NOTE: Lubricate the cylinder block bore and the crankshaft with clean engine oil before installing the seal.

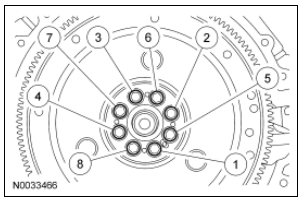
    Position the rear oil seal with protective installer onto the end of the crankshaft.



17. Using the special tool, install the rear main seal.



18. Install the flexplate and tighten the bolts in 2 stages in the sequence shown.
    - Stage 1: Tighten to 15 Nm (11 lb-ft).
    - Stage 2: Tighten to 110 Nm (81 lb-ft).

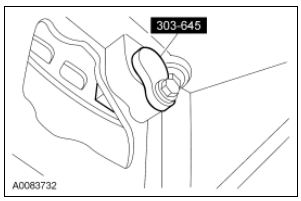


19. Mount the engine on a suitable engine stand.

20. **NOTE:** There is one window on the ignition pulse wheel that is unique to accept the special tool.

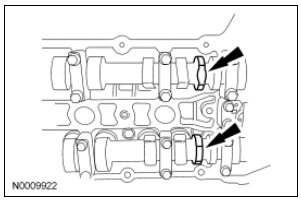
    Install the special tool.

    - Turn the crankshaft to 45 degrees ATDC. The crankshaft keyway will be in the 6 o'clock position.
    - Install the special tool.



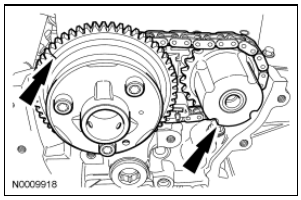
21. **NOTE:** LH shown, RH similar.

    Position all of the camshafts so the flats of the camshafts are facing upward.

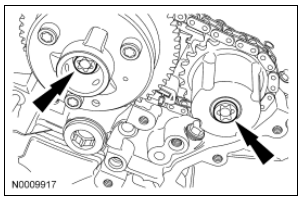


22. Install the LH secondary timing chain tensioner and 2 bolts.
    - Tighten to 11 Nm (8 lb-ft).

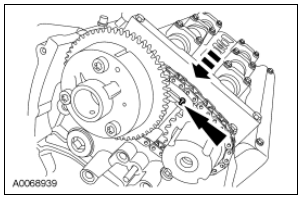
23. Install the LH variable cam timing (VCT) unit, exhaust camshaft sprocket and timing chain as an assembly.



24. Using new bolts, install the LH VCT unit and exhaust camshaft sprocket bolts finger-tight.

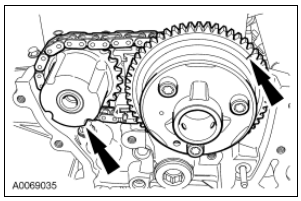


25. Remove the locking pin from the LH secondary timing chain tensioner.

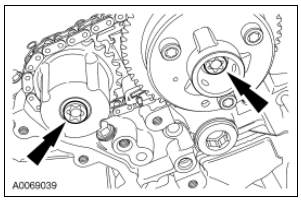


26. Install the RH secondary timing chain tensioner and 2 bolts.
    - Tighten to 11 Nm (8 lb-ft).

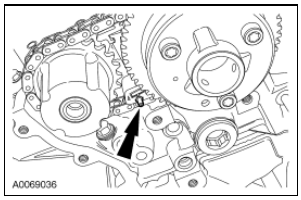
27. Install the RH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.



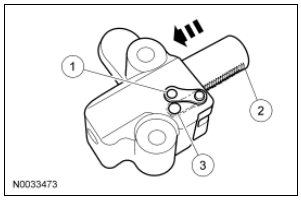
28. Using new bolts, install the RH VCT unit and exhaust camshaft sprocket bolts finger-tight.



29. Remove the locking pin from the RH secondary timing chain tensioner.

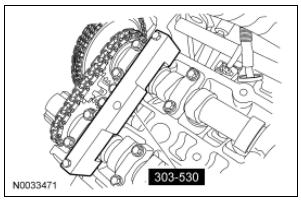


30. Reset the timing chain tensioners.
    1. Hold the lever toward the tensioner piston.
    2. Using finger pressure, compress the tensioner.
    3. Push the lever down and install a drill rod to lock the piston.



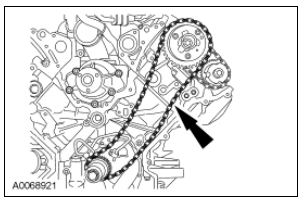
31. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

    Install the special tool on the LH head.

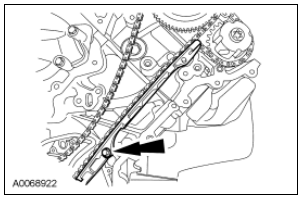


32. Position the LH timing chain and crankshaft gear.
    - Position the timing chain over the LH intake camshaft sprocket.

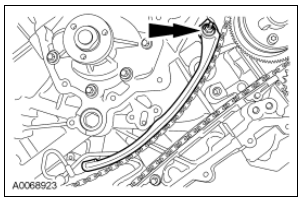
- Position the crankshaft gear in the timing chain.



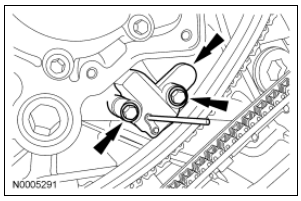
33. Install the LH timing chain guide and bolt.
    - Tighten to 11 Nm (8 lb-ft).



34. Install the LH timing chain tensioner arm and nut.
    - Tighten to 11 Nm (8 lb-ft).



35. Install the LH timing chain tensioner.
    - Install the timing chain tensioner and bolts, and remove the drill rod.

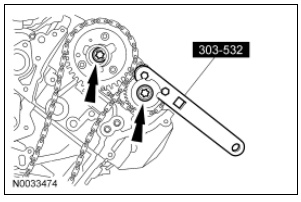


36. ***NOTICE:*** **The exhaust camshaft sprocket bolt must be fully tightened before tightening the intake camshaft sprocket bolt.**

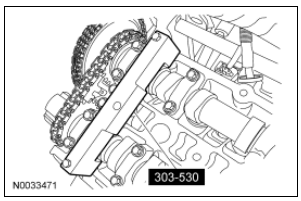
    NOTICE: **Using the special tool, apply 10 Nm (89 lb-in) counterclockwise to the LH exhaust camshaft sprocket.**

    Tighten the LH exhaust camshaft sprocket and variable camshaft timing (VCT) unit bolts in 2 stages.

    - Stage 1: Tighten to 35 Nm (26 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.

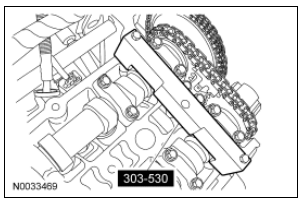


37. Remove the special tool.

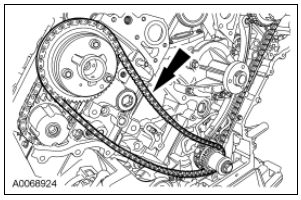


38. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

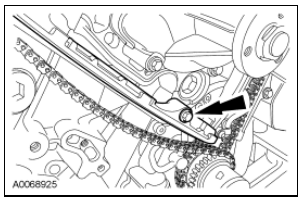
    Install the special tool on the right cylinder head.



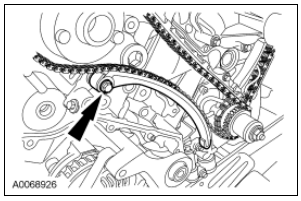
39. Position the RH timing chain over the RH intake camshaft sprocket and over the crankshaft gear.



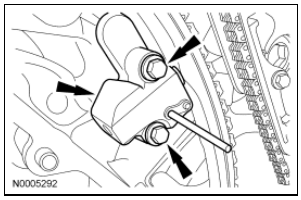
40. Install the RH timing chain guide and bolt.
    - Tighten to 11 Nm (8 lb-ft).



41. Install the RH timing chain tensioner arm.
    - Tighten to 11 Nm (8 lb-ft).



42. Install the RH timing chain tensioner.
    - Install the timing chain tensioner and bolts, and remove the drill rod.

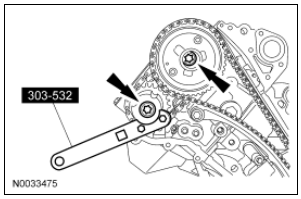


43. ***NOTICE:*** **The exhaust camshaft sprocket bolt must be fully tightened before tightening the intake camshaft sprocket bolt.**

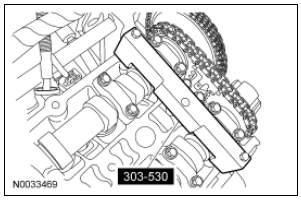
    NOTICE: **Using the special tool, apply 10 Nm (89 lb-in) counterclockwise to the RH exhaust camshaft sprocket.**

    Tighten the RH exhaust camshaft sprocket and VCT unit bolts in 2 stages.

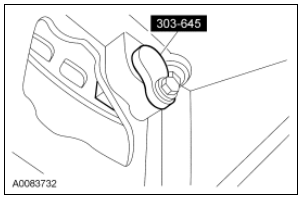
    - Stage 1: Tighten to 35 Nm (26 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



44. Remove the special tool.



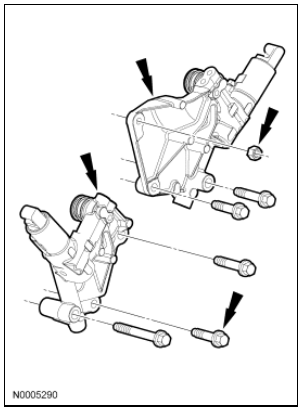
45. Remove the special tool.



46. **NOTE:** Lubricate the VCT bush carrier seals with clean engine oil.

    Carefully insert the bush carrier into the VCT unit, compress ring seals with fingers as required. Fully seat the bush carrier by hand before fitting the bolts and nut.

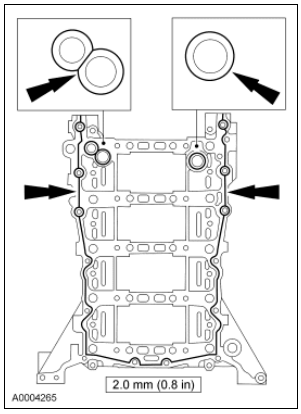
    - Tighten the bolts to 20 Nm (15 lb-ft).
    - Tighten the nut to 10 Nm (89 lb-in).



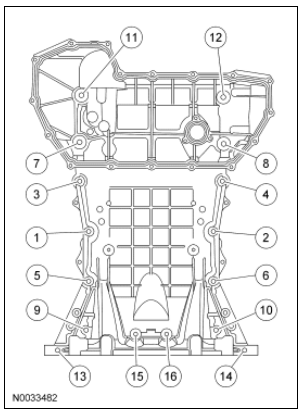
47. *NOTICE:* **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    NOTE: If the sump is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

    Apply 3 continuous beads of silicone gasket and sealant to the areas shown.

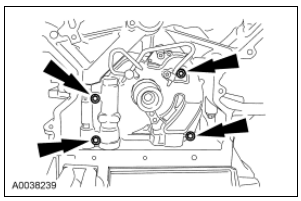


48. Install the oil sump. Using a straightedge, align the sump to the lower cylinder block. Tighten the bolts in sequence in 2 stages.
    - Stage 1: Tighten to 15 Nm (11 lb-ft).
    - Stage 2: Tighten to 25 Nm (18 lb-ft).



49. Install the oil pump and the 4 bolts.

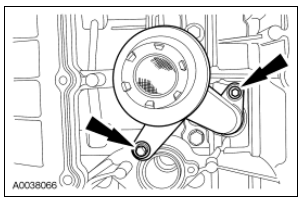
- Tighten to 12 Nm (9 lb-ft).



50. **NOTE:** Inspect the O-ring seal. Install a new O-ring seal if necessary. Lubricate the O-ring seal with clean engine oil.

    Install the oil pump screen cover and tube.

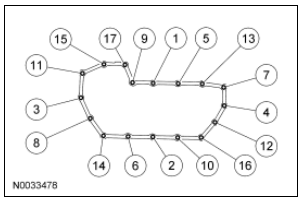
    - Tighten to 12 Nm (9 lb-ft).



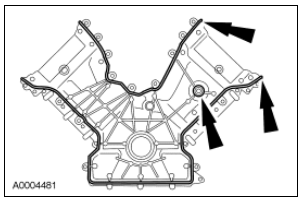
51. **NOTE:** Make sure all gasket sealing surfaces are clean and dry.

    Install a new oil pan gasket, oil pan and 17 bolts.

    - Tighten the bolts in the sequence shown in 2 stages.
        - ♦ Stage 1: Tighten to 5 Nm (44 lb-in).
        - ♦ Stage 2: Tighten to 12 Nm (9 lb-ft).

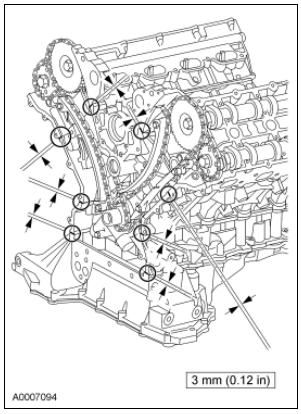


52. Install new engine front cover gaskets.

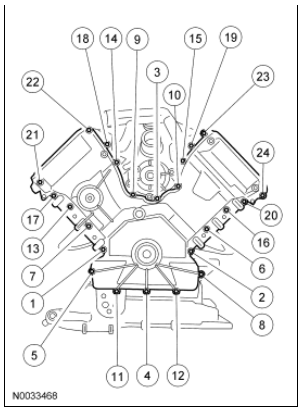


53. **NOTE:** If the front cover is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

    Apply silicone gasket and sealant in the 8 places shown.

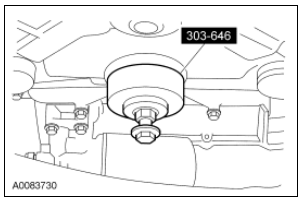


54. Install the engine front cover.
    - Position the engine front cover on the cylinder block.
    - Loosely install the bolts.
    - Tighten the bolts in 2 stages in the sequence shown.
        - Stage 1: Tighten to 5 Nm (44 lb-in).
        - Stage 2: Tighten to 10 Nm (89 lb-in).



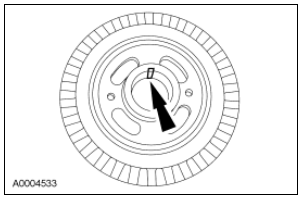
55. **NOTE:** Lubricate the front oil seal and the engine front cover mating surface with clean engine oil.

    Using the special tool, install a new front crankshaft seal.

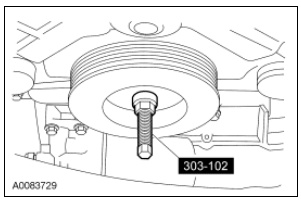


56. **NOTE:** If the crankshaft pulley is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

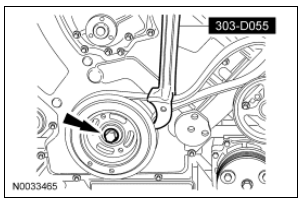
    Apply a bead of silicone gasket and sealant to the keyway.



57. Using the special tool, install the crankshaft pulley.



58. Install a new bolt and using the special tool to hold the pulley, tighten in 4 stages.
    - Stage 1: Tighten to 80 Nm (59 lb-ft).
    - Stage 2: Loosen the bolt 2 complete turns.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

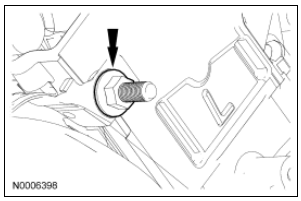


59. Install the 16 new exhaust manifold studs.
    - Tighten to 19 Nm (14 lb-ft).

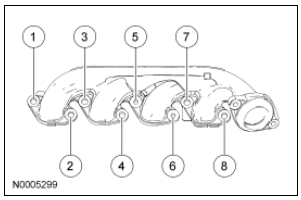
60. **NOTE:** LH shown, RH similar.

    Install the 2 new exhaust manifold gaskets and the 2 heat shield stud bolts.

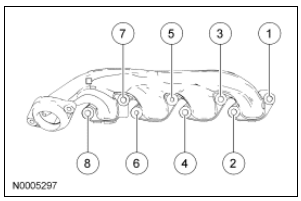
    - Tighten to 50 Nm (37 lb-ft).



61. Install the LH exhaust manifold and the 8 new nuts.
    - Tighten the nuts to 25 Nm (18 lb-ft) in the sequence shown.



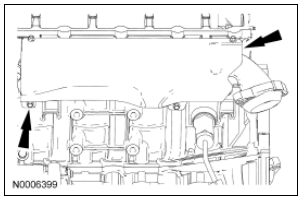
62. Install the RH exhaust manifold and the 8 new nuts.
    - Tighten the nuts to 25 Nm (18 lb-ft) in the sequence shown.



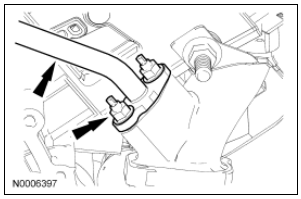
63. **NOTE:** LH shown, RH similar.

    Install the 2 exhaust manifold heat shields and 8 bolts.

    - Tighten to 3 Nm (27 lb-in).

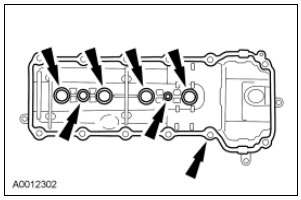


64. Install a new gasket, EGR tube and 2 nuts.
    - Tighten to 20 Nm (15 lb-ft).



65. **NOTE:** RH shown, LH similar.

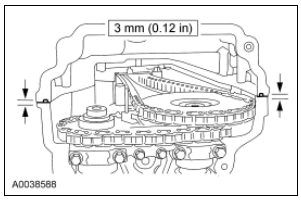
    Install new valve cover gaskets.



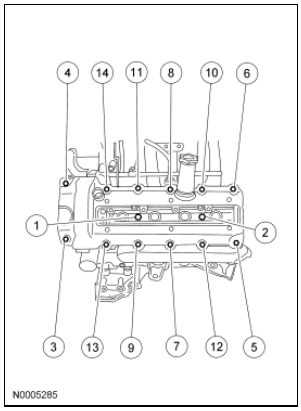
66. **NOTE:** RH shown, LH similar.

    NOTE: If the valve covers are not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

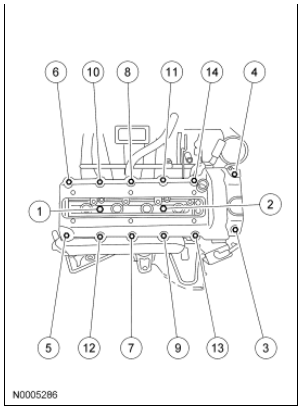
    Apply 4 beads of silicone gasket and sealant as shown.



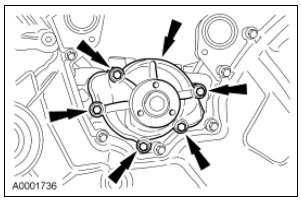
67. Install the LH valve cover.
    - Tighten the bolts in the sequence shown to 10 Nm (89 lb-in).



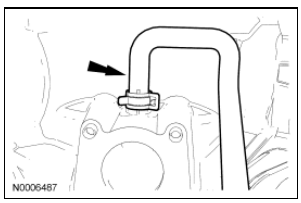
68. Install the RH valve cover.
    - Tighten the bolts in the sequence shown to 10 Nm (89 lb-in).



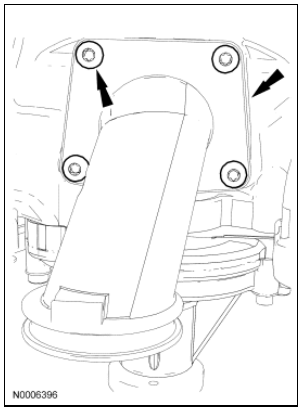
69. Install a new gasket and the coolant pump.
    - Install the 5 bolts and tighten in 2 stages.
        - ♦ Stage 1: Tighten to 8 Nm (71 lb-in).
        - ♦ Stage 2: Tighten an additional 90 degrees.



70. Install the throttle body coolant hose.

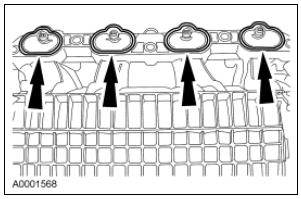


71. Install a new O-ring seal, the coolant inlet housing and the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).



72. Install new O-ring seals, the coolant bypass housing and the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

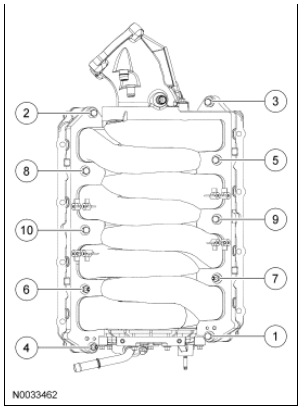
73. Install new intake manifold gaskets.



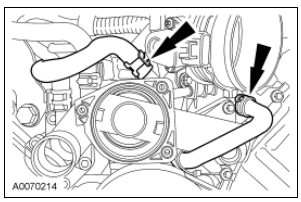
74. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

    Install the intake manifold, the 7 bolts and the 3 studs.

    - Tighten the 7 bolts and the 3 studs in the sequence shown to 20 Nm (15 lb-ft).



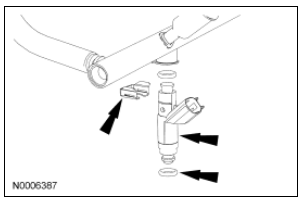
75. Connect the 2 throttle body coolant hoses.



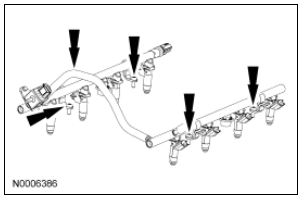
76. ***NOTICE:*** **Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.**

    Install 16 new O-ring seals onto the fuel injectors.

    - Lubricate the O-ring seals with clean engine oil.
    - Install the fuel injectors and clips onto the fuel rail.



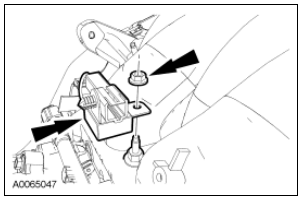
77. Install the fuel rail and injector assembly and the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).



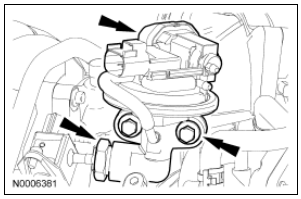
78. **NOTE:** RH shown, LH similar.

    Install the 2 radio interference ignition capacitors and nuts.

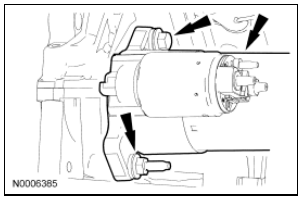
    - Tighten to 10 Nm (89 lb-in).



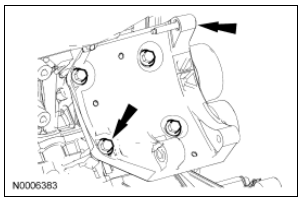
79. Install a new gasket, the exhaust gas recirculation (EGR) system module and bolts.
    - Tighten the bolts to 25 Nm (18 lb-ft).
    - Tighten the EGR tube nut to 40 Nm (30 lb-ft).



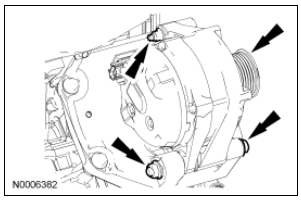
80. Install the starter motor and 2 bolts.
    - Tighten to 25 Nm (18 lb-ft).



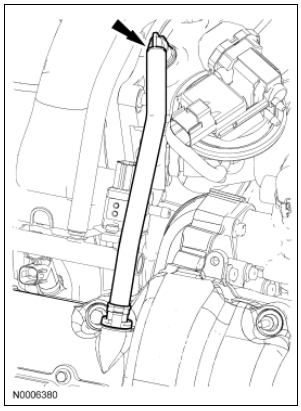
81. Install the generator bracket and 4 bolts.
    - Tighten to 42 Nm (31 lb-ft).



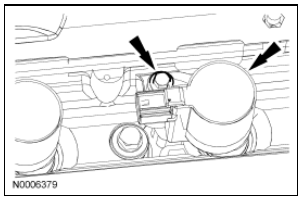
82. Install the generator, the bolt and the 2 nuts.
    - Tighten to 40 Nm (30 lb-ft).



83. Install the crankcase vent tube.



84. Install the 8 ignition coils and bolts.
    - Tighten to 5 Nm (44 lb-in).

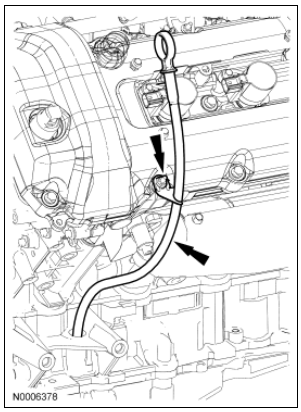


85. ***NOTICE:*** **Failure to lubricate the O-ring seal and the oil level indicator tube-to-engine block mating surface with clean engine oil can result in engine oil leaks.**

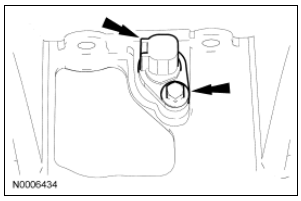
    NOTICE: **Make sure the O-ring seal remains in position and does not roll up the indicator tube during installation.**

Install a new O-ring seal, oil level indicator tube and nut.

- Lubricate the new O-ring seal and engine mating surface with clean engine oil.
- Tighten to 6 Nm (53 lb-in).

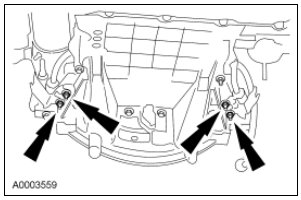


86. Install the crankshaft position (CKP) sensor and bolt.
    - Tighten to 10 Nm (89 lb-in).

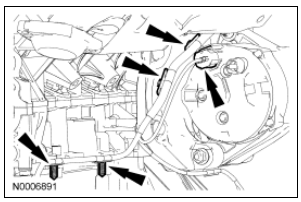


87. Position the engine wiring harness onto the engine.

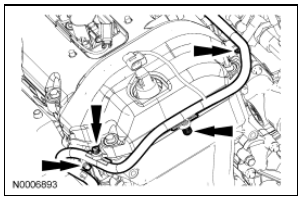
88. Attach the heated oxygen sensor (HO2S) electrical connectors onto the brackets.



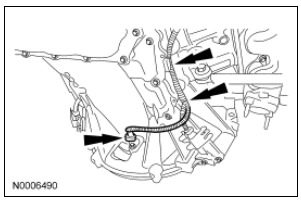
89. Connect the generator electrical connector and wiring harness retainers.



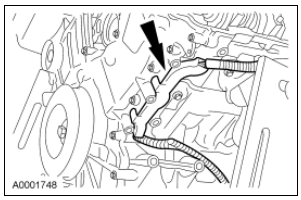
90. Connect the wiring harness retainers to the RH valve cover.



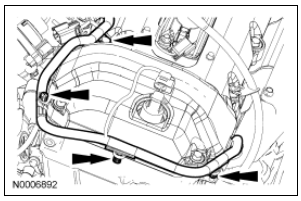
91. Connect the CKP sensor electrical connector and wiring harness retainers.



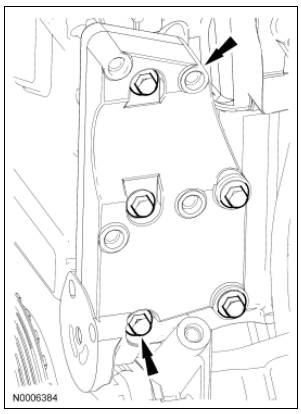
92. Attach the wiring harness onto the front cover.



93. Connect the wiring harness retainers to the LH valve cover.

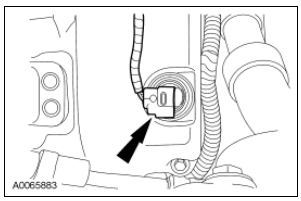


94. Install the power steering bracket and 5 bolts.
    - Tighten to 25 Nm (18 lb-ft).

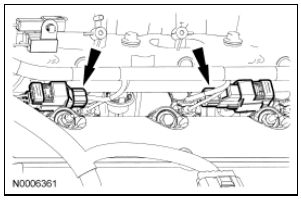


95. **NOTE:** RH shown, LH similar.

    Connect the 2 VCT sensor electrical connectors.

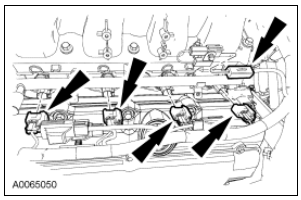


96. Connect the KS and CMP sensor electrical connectors.
    - Attach the pin-type retainers.



97. **NOTE:** LH shown, RH similar.

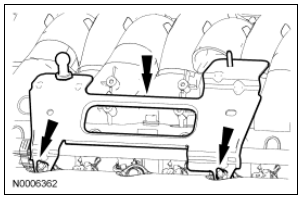
    Connect the 8 fuel injectors and the 2 radio interference capacitor electrical connectors.



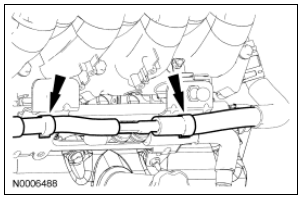
98. **NOTE:** RH shown, LH similar.

    Install the 2 engine appearance cover brackets and the 4 nuts.

    - Tighten to 6 Nm (53 lb-in).

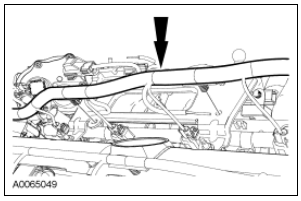


99. Attach the vacuum hose retainers onto the LH engine appearance cover support bracket.

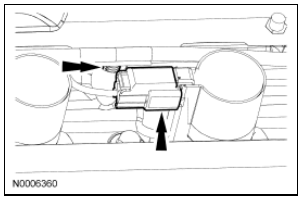


100. **NOTE:** LH shown, RH similar.

     Connect the engine wiring harness retainers to the engine appearance cover support brackets.

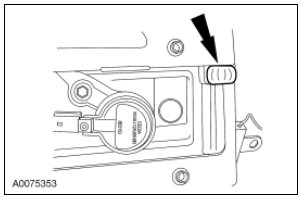


101. Connect the 8 ignition coil electrical connectors.

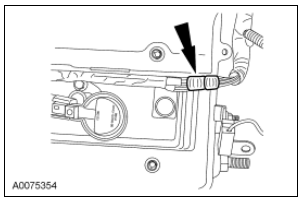


102. **NOTE:** Remove all dirt and moisture from the valve cover before applying silicone sealer.

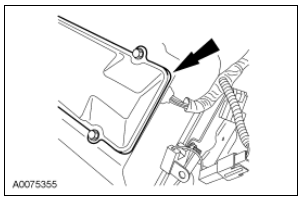
    Lift up the wire harness and apply a 12.7 mm (0.5 in) bead of silicone sealer in the notch of the valve cover.



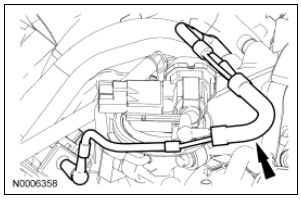
103. Set the ignition coil harness in the bead of silicone sealer and apply enough additional sealer to surround the wiring harness and notch.



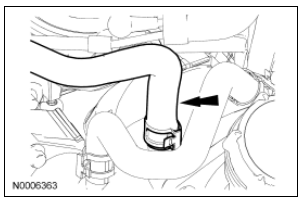
104. Install the ignition coil covers.
    - Tighten to 10 Nm (89 lb-in).



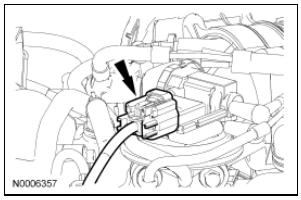
105. Install the vacuum harness.



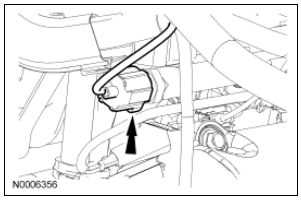
106. Connect the coolant vent hose to the coolant outlet.



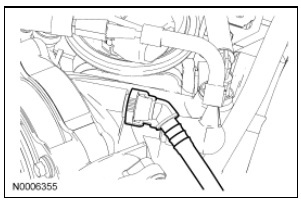
107. Connect the EGR system module electrical connector.



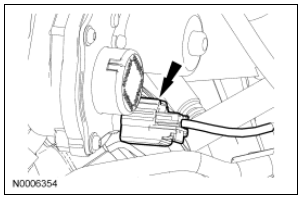
108. Connect the fuel rail temperature sensor electrical connector.



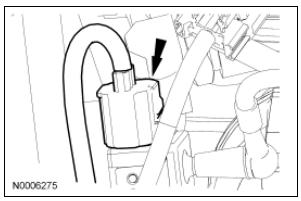
109. Connect the evaporative emissions (EVAP) tube.



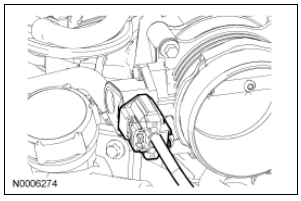
110. Connect the electronic throttle body electrical connector.



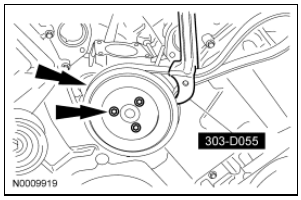
111. Connect the fuel pressure sensor electrical connector.



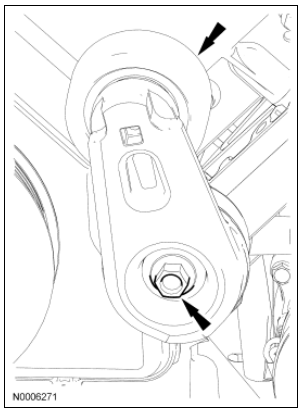
112. Connect the throttle position (TP) sensor electrical connector.



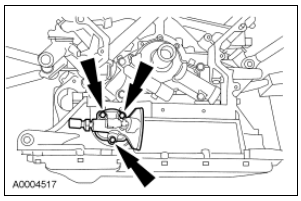
113. Using the special tool, install the coolant pump pulley and 3 bolts.
    - Tighten to 10 Nm (89 lb-in).



114. Remove the bolt and the accessory drive belt tensioner.
    - Tighten to 25 Nm (18 lb-ft).



115. Install new O-ring seals, the oil filter adapter and 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

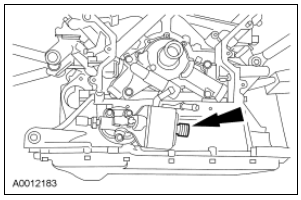


116. ***NOTICE:*** **A new oil cooler must be installed or severe damage to the engine can occur.**

    NOTE: Lubricate the gasket with clean engine oil.

    Position the new oil cooler, new gasket and install the bolt.

    - Rotate the cooler clockwise until the locating pin hits the stop.
    - Tighten the bolt to 60 Nm (44 lb-ft).

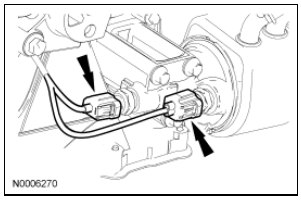


117. **NOTE:** Lubricate the gasket with clean engine oil.

    Install a new oil filter and gasket until the seal makes contact.

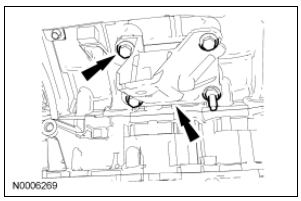
    - Using an oil filter strap wrench, tighten the filter an additional 270 degrees.

118. Connect the oil pressure and oil temperature sensor electrical connectors.

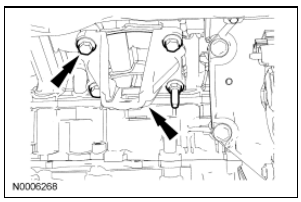


119. Install the engine block drain plug.
    - Tighten to 50 Nm (37 lb-ft).

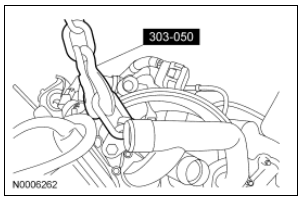
120. Install the LH engine mount bracket, stud bolt and 3 bolts.
    - Tighten to 40 Nm (30 lb-ft).



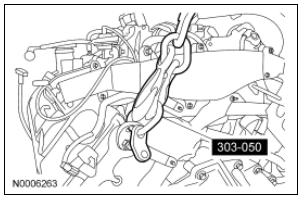
121. Install the RH engine mount bracket, stud bolt and 3 bolts.
    - Tighten to 40 Nm (30 lb-ft).



122. Install the special tool.



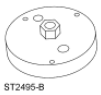
123. Install the special tool.



124. Install the engine lifting equipment and remove the engine from the stand.

Cylinder Heads

Special Tool(s)

ST2423-A	Installer, Crankshaft Front Oil Seal 303-646
ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
ST2398-B	Aligner, Camshaft 303-530
ST2399-A	Tensioner, Timing Chain 303-532
ST2401-A	Alignment Gauge, Crankshaft 303-645
 ST2495-B	Remover/Installer, Crankshaft Rear Oil Seal 303-647
ST2441-A	Adapter for 204-185 204-208 (T95T-5310-AR2)
ST1595-A	Lifting Brackets, Engine 303-050 (T70P-6000)
ST1602-A	Spreader Bar 303-D089 (D93P-6001-A3)

Material

Item	Specification
Motorcraft Metal Surface Cleaner ZC-21	WSE-M5B392-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

NOTICE: **The gasket sealing surfaces on the cylinder head and cylinder block must be clean and dry.**

NOTICE: **The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.**

NOTICE: **The new gasket has a film coating which is crucial to the gasket's ability to seal correctly. Do not scratch the gasket.**

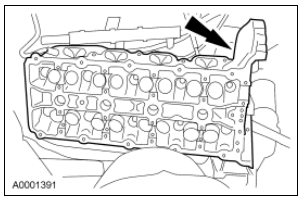
NOTICE: **Cylinder head machining or milling is not authorized by Ford Motor Company. Cylinder head flatness must be within 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area.**

NOTICE: **Do not allow the dowels to scratch the sealing surface of the cylinder head during cylinder head installation.**

RH side

1. Lightly oil the new cylinder head bolts and allow to drain for a few minutes before installing.

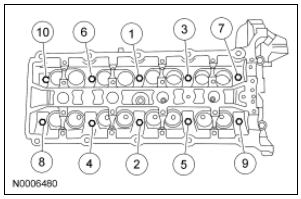
2. Install a new gasket and position the RH cylinder head on the engine.



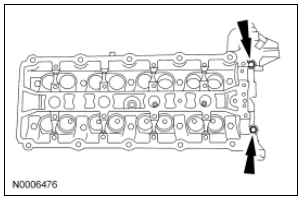
3. **NOTE:** The cylinder head bolts are a torque-to-yield design and must not be reused. Always use new bolts.

   Install and tighten the RH head bolts in 4 stages in the sequence shown.

   - Stage 1: Tighten bolts 1 through 10 to 20 Nm (15 lb-ft).
   - Stage 2: Tighten bolts 1 through 10 to 35 Nm (26 lb-ft).
   - Stage 3: Tighten bolts 1 through 10 to 45 Nm (33 lb-ft) and an additional 90 degrees.
   - Stage 4: Tighten bolts 1 through 10 an additional 90 degrees.



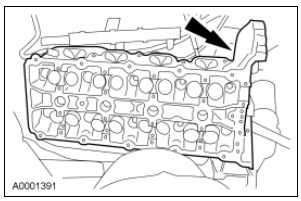
4. Install the 2 end bolts and tighten in 2 stages.
   - Stage 1: Tighten to 20 Nm (15 lb-ft).
   - Stage 2: Tighten an additional 90 degrees.



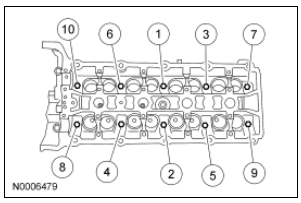
LH side

5. Lightly oil the new cylinder head bolts and allow to drain for a few minutes before installing.

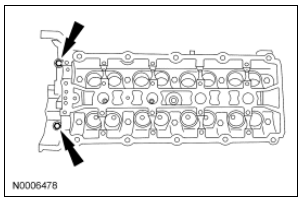
6. Install a new gasket and position the LH cylinder head on the engine.



7. Install and tighten the LH head bolts in 4 stages in the sequence shown.
   - Stage 1: Tighten bolts 1 through 10 to 20 Nm (15 lb-ft).
   - Stage 2: Tighten bolts 1 through 10 to 35 Nm (26 lb-ft).
   - Stage 3: Tighten bolts 1 through 10 to 45 Nm (33 lb-ft) and an additional 90 degrees.
   - Stage 4: Tighten bolts 1 through 10 an additional 90 degrees.



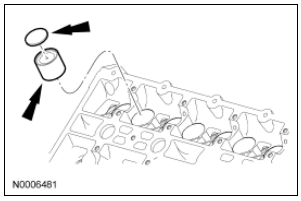
8. Install the 2 end bolts and tighten in 2 stages.
   - Stage 1: Tighten to 20 Nm (15 lb-ft).
   - Stage 2: Tighten an additional 90 degrees.



Both sides

9. **NOTE:** Coat the valve tappets with clean engine oil prior to installing.

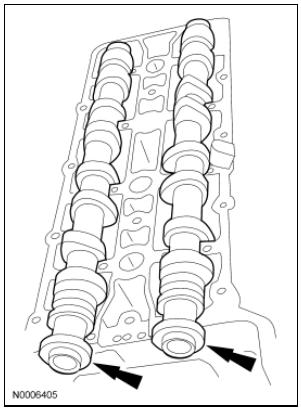
   Install the valve tappets and shims in their original locations.



RH side

10. **NOTE:** Apply clean engine oil to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

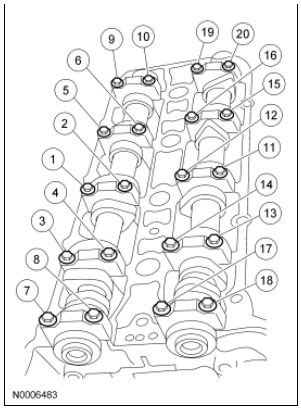
    Position the RH camshafts on the camshaft journals.



11. ***NOTICE:*** **CAUTION: Install the camshaft bearing caps. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

    Install the RH camshaft bearing caps.

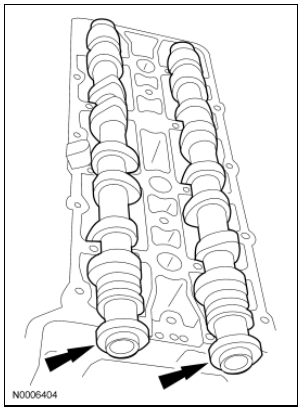
    - Position the bearing caps.
    - Install the bearing cap bolts. Tighten the bolts in 3 stages in the sequence shown.
        - ♦ Stage 1: Hand-tighten.
        - ♦ Stage 2: Tighten to 6 Nm (53 lb-in).
        - ♦ Stage 3: Tighten an additional 90 degrees.



LH side

12. **NOTE:** Apply clean engine oil to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

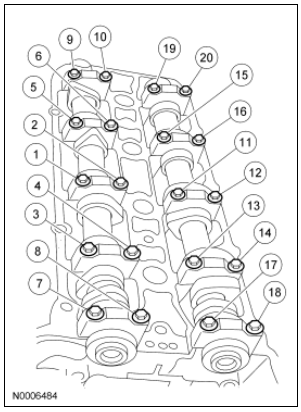
    Position the LH camshafts on the camshaft journals.



13. ***NOTICE:*** **Install the camshaft bearing caps. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage can occur.**

    Install the LH camshaft bearing caps.

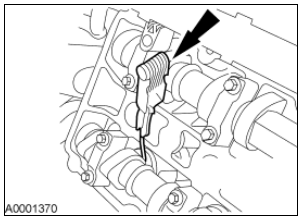
    - Position the bearing caps.
    - Install the bearing cap bolts. Tighten the bolts in 3 stages in the sequence shown.
        - ♦ Stage 1: Hand-tighten.
        - ♦ Stage 2: Tighten to 6 Nm (53 lb-in).
        - ♦ Stage 3: Tighten an additional 90 degrees.



Both sides

14. ***NOTICE:*** **If any components are installed new, the engine must be reshimmed or engine damage can occur.**

    Using a feeler gauge, confirm that the tappet and shim clearances are within specification. For additional information, refer to Valve Clearance Check in this section.

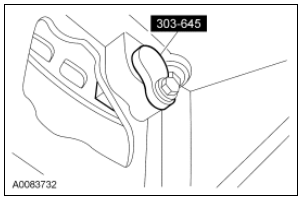


15. If tappet and shim clearances are not within specification, adjust the clearance. For additional information, refer to Valve Clearance Adjustment in this section.

16. **NOTE:** There is one window on the ignition pulse wheel that is unique to accept the special tool.

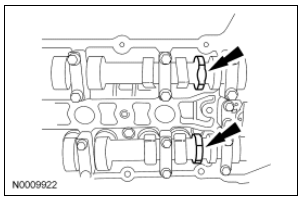
Install the special tool.

- Turn the crankshaft to 45 degrees ATDC. The crankshaft keyway will be in the 6 o'clock position.
- Install the special tool.



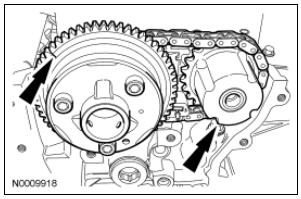
17. **NOTE:** LH shown, RH similar.

    Position all of the camshafts so the flats of the camshafts are facing upward.

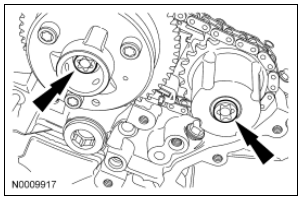


18. Install the LH secondary timing chain tensioner and 2 bolts.
    - Tighten to 11 Nm (8 lb-ft).

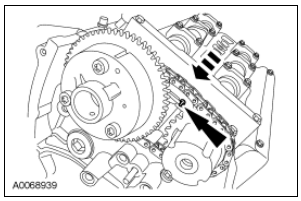
19. Install the LH variable cam timing (VCT) unit, exhaust camshaft sprocket and timing chain as an assembly.



20. Using new bolts, install the LH VCT unit and exhaust camshaft sprocket bolts finger-tight.

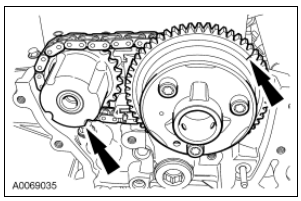


21. Remove the locking pin from the LH secondary timing chain tensioner.

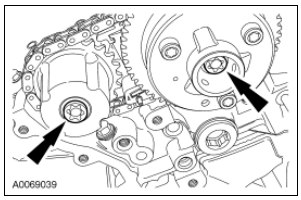


22. Install the RH secondary timing chain tensioner and 2 bolts.
    - Tighten to 11 Nm (8 lb-ft).

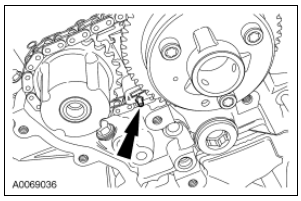
23. Install the RH VCT unit, exhaust camshaft sprocket and timing chain as an assembly.



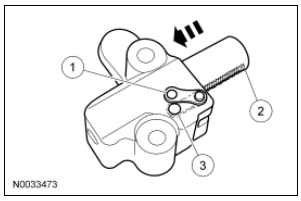
24. Using new bolts, install the RH VCT unit and exhaust camshaft sprocket bolts finger-tight.



25. Remove the locking pin from the RH secondary timing chain tensioner.

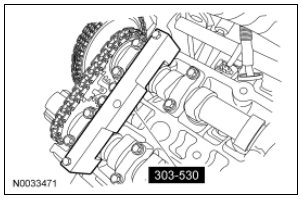


26. Reset the timing chain tensioners.
    1. Hold the lever toward the tensioner piston.
    2. Using finger pressure, compress the tensioner.
    3. Push the lever down and install a drill rod to lock the piston.

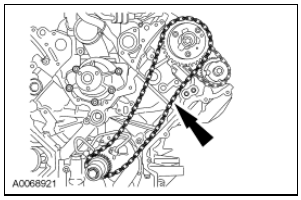


27. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool down evenly until it is fully seated on the camshaft flats.**

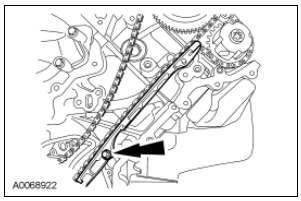
    Install the special tool on the LH head.



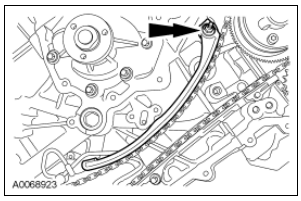
28. Position the LH timing chain and crankshaft gear.
    - Position the timing chain over the LH intake camshaft sprocket.
    - Position the crankshaft gear in the timing chain.



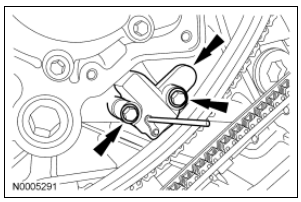
29. Install the LH timing chain guide and bolt.
    - Tighten to 11 Nm (8 lb-ft).



30. Install the LH timing chain tensioner arm and nut.
    - Tighten to 11 Nm (8 lb-ft).



31. Install the LH timing chain tensioner.
    - Install the timing chain tensioner and bolts, and remove the drill rod.

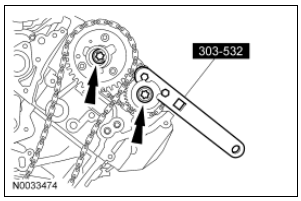


32. ***NOTICE:*** **The exhaust camshaft sprocket bolt must be fully tightened before tightening the intake camshaft sprocket bolt.**

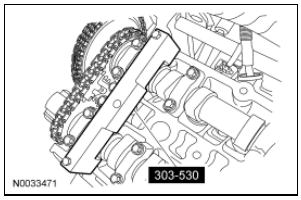
    NOTICE: **Using the special tool, apply 10 Nm (89 lb-in) counterclockwise to the LH exhaust camshaft sprocket.**

    Tighten the LH exhaust camshaft sprocket and variable camshaft timing (VCT) unit bolts in 2 stages.

    - Stage 1: Tighten to 35 Nm (26 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.

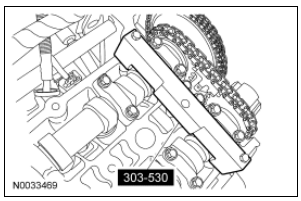


33. Remove the special tool.

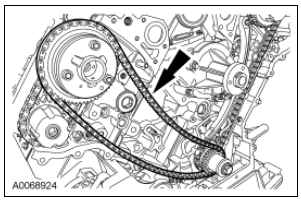


34. ***NOTICE:*** **The flats on the camshaft must completely contact the special service tool or damage to the camshafts can occur. Slowly draw the special tool downward evenly until it is fully seated on the camshaft flats.**

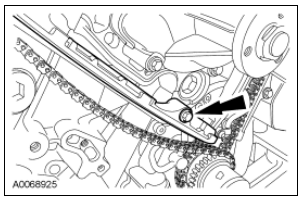
    Install the special tool on the right cylinder head.



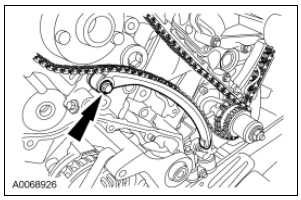
35. Position the RH timing chain over the RH intake camshaft sprocket and over the crankshaft gear.



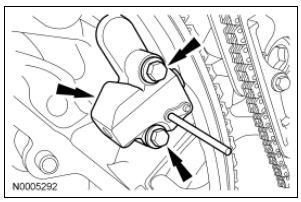
36. Install the RH timing chain guide and bolt.
    - Tighten to 11 Nm (8 lb-ft).



37. Install the RH timing chain tensioner arm.
    - Tighten to 11 Nm (8 lb-ft).



38. Install the RH timing chain tensioner.
    - Install the timing chain tensioner and bolts, and remove the drill rod.

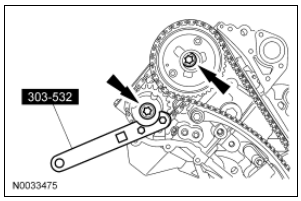


39. ***NOTICE:*** **The exhaust camshaft sprocket bolt must be fully tightened before tightening the intake camshaft sprocket bolt.**

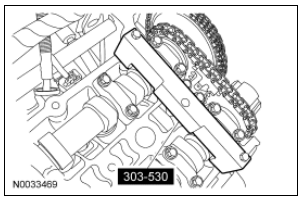
    NOTICE: **Using the special tool, apply 10 Nm (89 lb-in) counterclockwise to the RH exhaust camshaft sprocket.**

    Tighten the RH exhaust camshaft sprocket and VCT unit bolts in 2 stages.

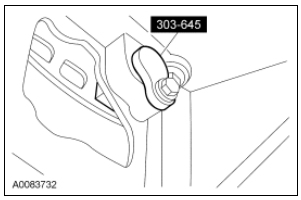
    - Stage 1: Tighten to 35 Nm (26 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



40. Remove the special tool.



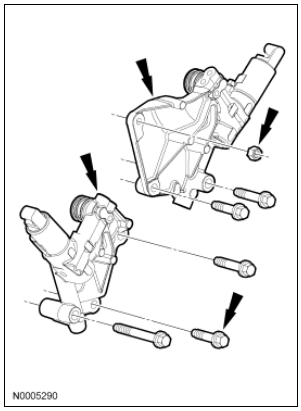
41. Remove the special tool.



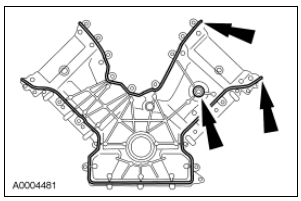
42. **NOTE:** Lubricate the VCT bush carrier seals with clean engine oil.

    Carefully insert the bush carrier into the VCT unit, compress ring seals with fingers as required. Fully seat the bush carrier by hand before fitting the bolts and nut.

    - Tighten the bolts to 20 Nm (15 lb-ft).
    - Tighten the nut to 10 Nm (89 lb-in).

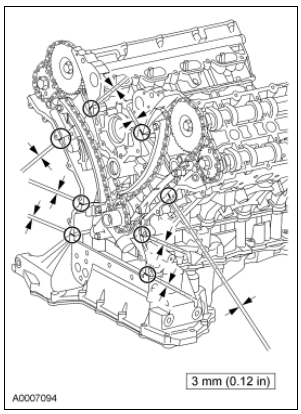


43. Install new engine front cover gaskets.

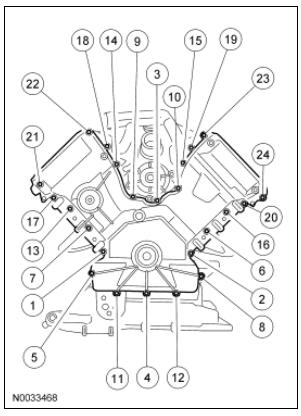


44. **NOTE:** If the front cover is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

    Apply silicone gasket and sealant in the 8 places shown.

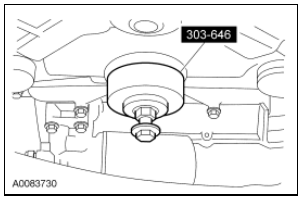


45. Install the engine front cover.
    - Position the engine front cover on the cylinder block.
    - Loosely install the bolts.
    - Tighten the bolts in 2 stages in the sequence shown.
        - Stage 1: Tighten to 5 Nm (44 lb-in).
        - Stage 2: Tighten to 10 Nm (89 lb-in).



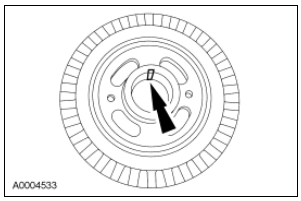
46. **NOTE:** Lubricate the front oil seal and the engine front cover mating surface with clean engine oil.

    Using the special tool, install a new front crankshaft seal.

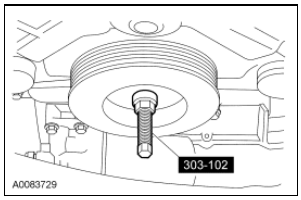


47. **NOTE:** If the crankshaft pulley is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

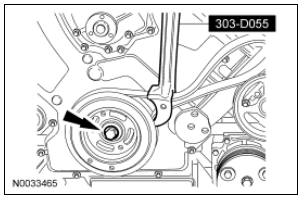
    Apply a bead of silicone gasket and sealant to the keyway.



48. Using the special tool, install the crankshaft pulley.



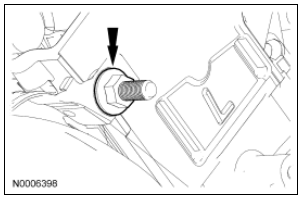
49. Install a new bolt and using the special tool to hold the pulley, tighten in 4 stages.
    - Stage 1: Tighten to 80 Nm (59 lb-ft).
    - Stage 2: Loosen the bolt 2 complete turns.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.



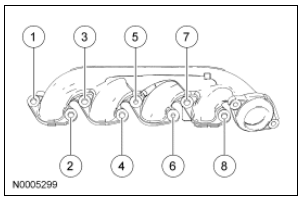
LH side

50. Install the 8 new LH exhaust manifold studs.
    - Tighten to 19 Nm (14 lb-ft).

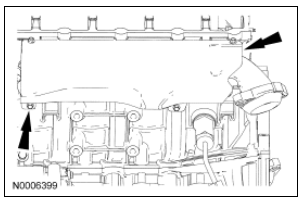
51. Install the new LH exhaust manifold gasket and the heat shield stud bolt.
    - Tighten to 50 Nm (37 lb-ft).



52. Install the LH exhaust manifold and the 8 new nuts.
    - Tighten the nuts to 25 Nm (18 lb-ft) in the sequence shown.



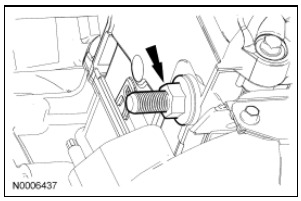
53. Install the LH exhaust manifold heat shield and 4 bolts.
    - Tighten to 3 Nm (27 lb-in).



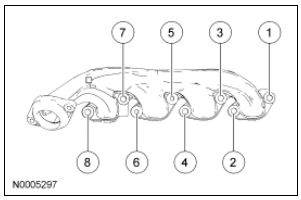
RH side

54. Install the 8 new RH exhaust manifold studs.
    - Tighten to 19 Nm (14 lb-ft).

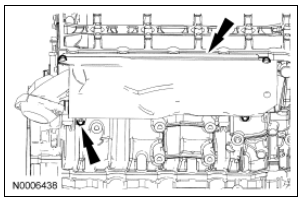
55. Install the new RH exhaust manifold gasket and the heat shield stud bolt.
    - Tighten to 50 Nm (37 lb-ft).



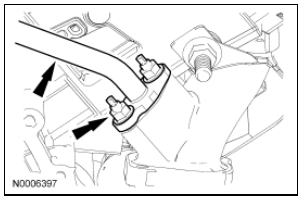
56. Install the RH exhaust manifold and the 8 new nuts.
    - Tighten the nuts to 25 Nm (18 lb-ft) in the sequence shown.



57. Install the RH exhaust manifold heat shield and 4 bolts.
    - Tighten to 3 Nm (27 lb-in).



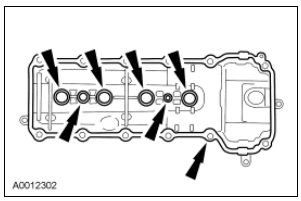
58. Install a new gasket, EGR tube and 2 nuts.
    - Tighten to 20 Nm (15 lb-ft).



Both sides

59. **NOTE:** RH shown, LH similar.

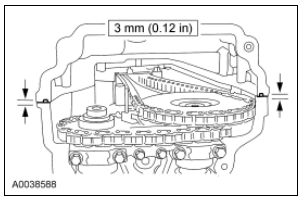
    Install new valve cover gaskets.



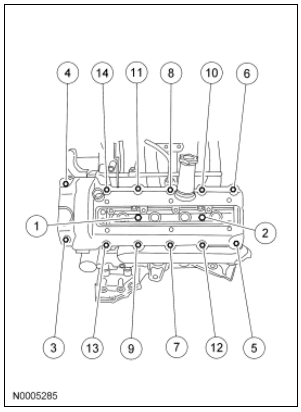
60. **NOTE:** RH shown, LH similar.

    NOTE: If the valve covers are not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

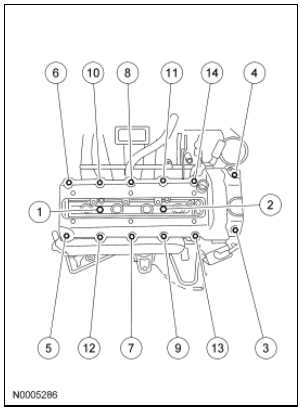
    Apply 4 beads of silicone gasket and sealant as shown.



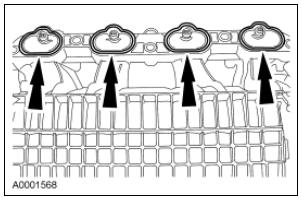
61. Install the LH valve cover.
    - Tighten the bolts in the sequence shown to 10 Nm (89 lb-in).



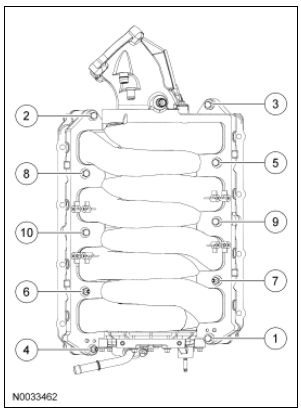
62. Install the RH valve cover.
    - Tighten the bolts in the sequence shown to 10 Nm (89 lb-in).



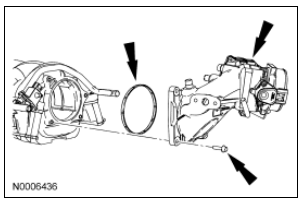
63. Install new intake manifold gaskets.



64. Install the intake manifold, the 7 bolts and the 3 studs.
    - Tighten the 7 bolts and the 3 studs in the sequence shown to 20 Nm (15 lb-ft).

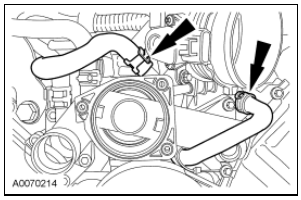


65. Install a new gasket, the throttle body adapter and the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).



66. Install new O-ring seals, the coolant bypass housing and the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

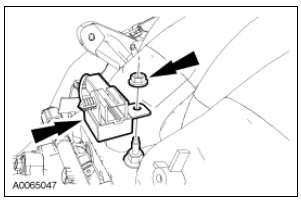
67. Connect the 2 throttle body coolant hoses.



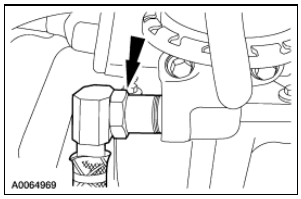
68. **NOTE:** RH shown, LH similar.

    Install the 2 radio interference ignition capacitors and the 2 nuts.

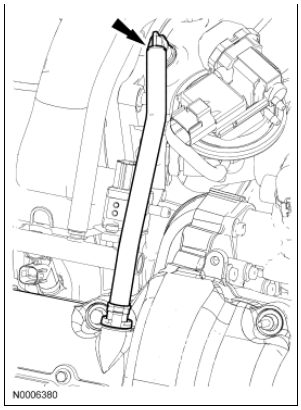
    - Tighten to 10 Nm (89 lb-in).



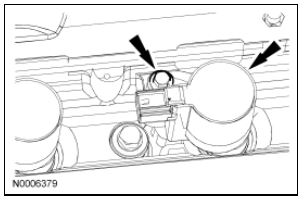
69. Connect the exhaust manifold tube to the exhaust gas recirculation (EGR) system module.
    - Tighten to 40 Nm (30 lb-ft).



70. Install the crankcase vent tube.



71. Install the 8 ignition coils and bolts.
    - Tighten to 5 Nm (44 lb-in).

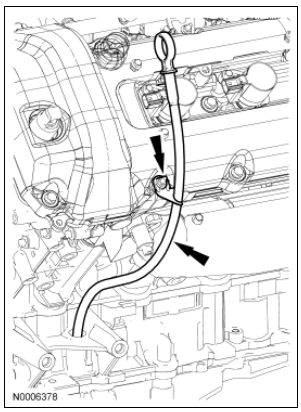


72. ***NOTICE:*** **Failure to lubricate the O-ring seal and the oil level indicator tube-to-engine block mating surface with clean engine oil can result in engine oil leaks.**

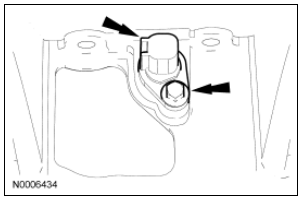
NOTICE: **Make sure the O-ring seal remains in position and does not roll up the indicator tube during installation.**

Install a new O-ring seal, oil level indicator tube and nut.

- Lubricate the new O-ring seal and engine mating surface with clean engine oil.
- Tighten to 6 Nm (53 lb-in).

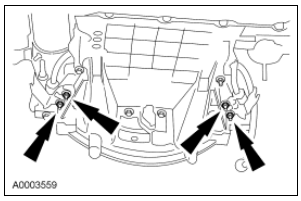


73. Install the crankshaft position (CKP) sensor and bolt.
    - Tighten to 10 Nm (89 lb-in).

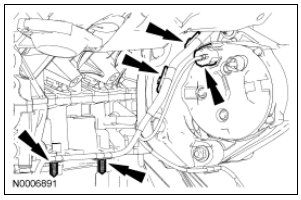


74. Position the engine wiring harness onto the engine.

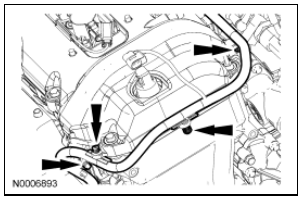
75. Attach the heated oxygen sensor (HO2S) electrical connectors onto the brackets.



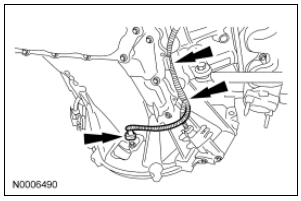
76. Connect the generator electrical connector and wiring harness retainers.



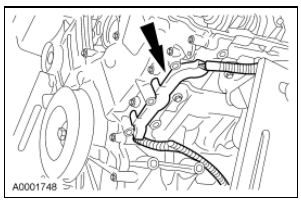
77. Connect the wiring harness retainers to the RH valve cover.



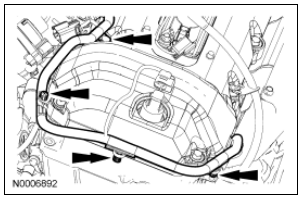
78. Connect the CKP sensor electrical connector and wiring harness retainers.



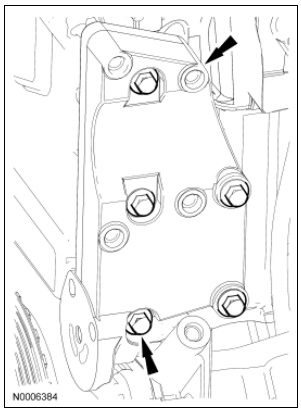
79. Attach the wiring harness onto the front cover.



80. Connect the wiring harness retainers to the LH valve cover.

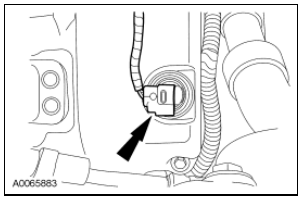


81. Install the power steering bracket and 5 bolts.
    - Tighten to 25 Nm (18 lb-ft).

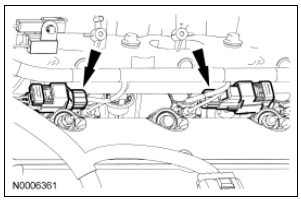


82. **NOTE:** RH shown, LH similar.

    Connect the VCT sensor electrical connectors.

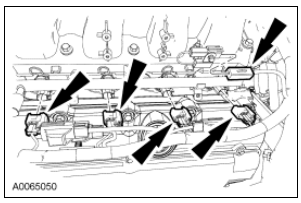


83. Connect the KS and CMP sensor electrical connectors.
    - Attach the pin-type retainers.



84. **NOTE:** LH shown, RH similar.

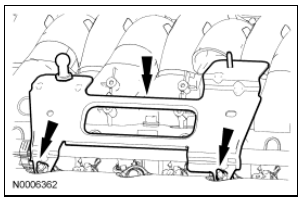
    Connect the 8 fuel injector and the 2 radio interference capacitor electrical connectors.



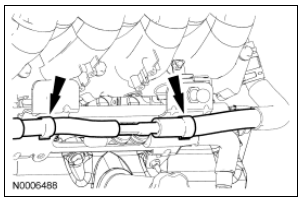
85. **NOTE:** RH shown, LH similar.

    Install the 2 engine appearance cover brackets and the 4 nuts.

    - Tighten to 6 Nm (53 lb-in).

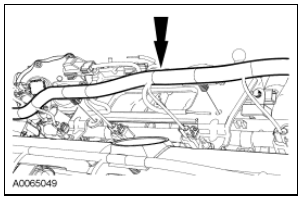


86. Attach the vacuum hose retainers onto the LH engine appearance cover support bracket.

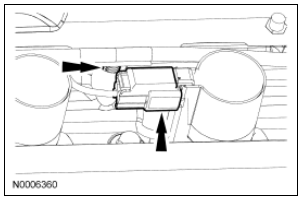


87. **NOTE:** LH shown, RH similar.

    Connect the engine wiring harness retainers to the engine appearance cover support brackets.

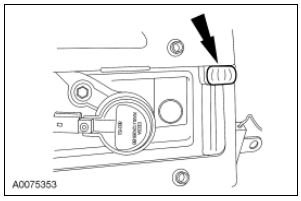


88. Connect the 8 ignition coil electrical connectors.

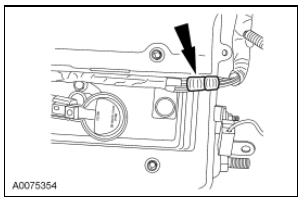


89. **NOTE:** Remove all dirt and moisture from the valve cover before applying silicone sealer.

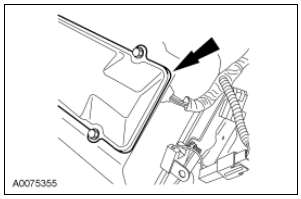
    Lift up the wiring harness and apply a 12.7 mm (0.5 in) bead of silicone sealer in the notch of the valve cover.



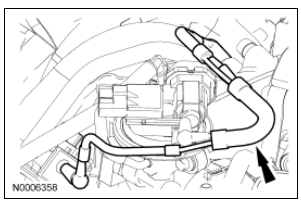
90. Set the ignition coil harness in the bead of silicone sealer and apply enough additional sealer to surround the wire harness and notch.



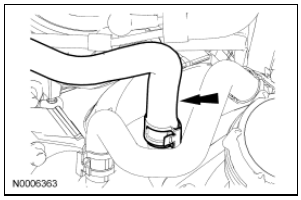
91. Install the ignition coil covers.
    - Tighten to 10 Nm (89 lb-in).



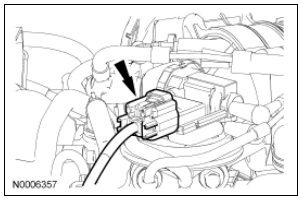
92. Install the vacuum harness.



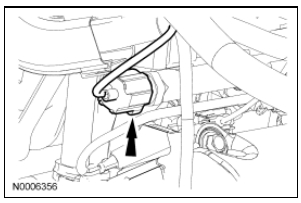
93. Connect the coolant vent hose to the coolant outlet.



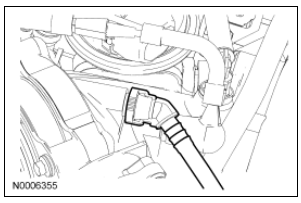
94. Connect the EGR system module electrical connector.



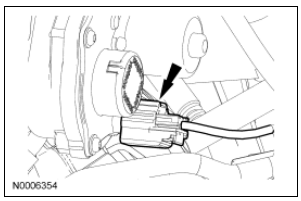
95. Connect the fuel rail temperature sensor electrical connector.



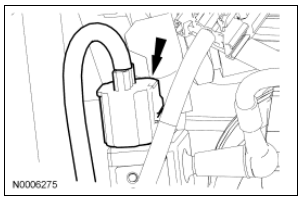
96. Connect the evaporative emissions (EVAP) tube.



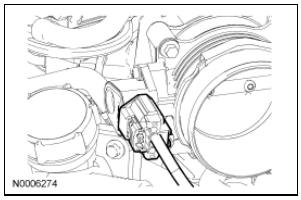
97. Connect the electronic throttle body electrical connector.



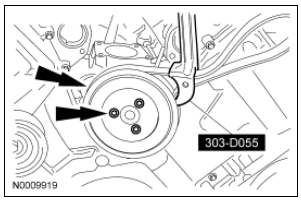
98. Connect the fuel pressure sensor electrical connector.



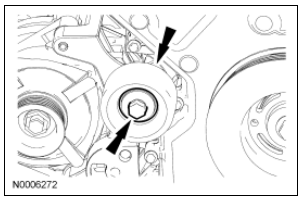
99. Connect the throttle position (TP) sensor electrical connector.



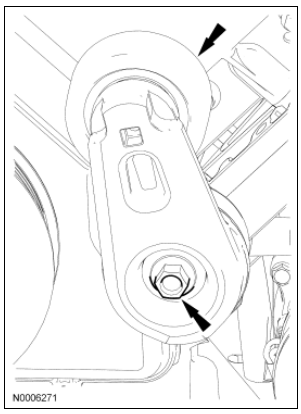
100. Using the special tool, install the coolant pump pulley and 3 bolts.
    - Tighten to 10 Nm (89 lb-in).



101. Install the accessory drive belt idler pulley and bolt.
    - Tighten to 25 Nm (18 lb-ft).



102. Remove the bolt and the accessory drive belt tensioner.
    - Tighten to 25 Nm (18 lb-ft).

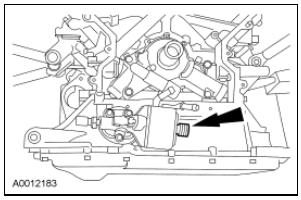


103. ***NOTICE:*** **A new oil cooler must be installed or severe damage to the engine can occur.**

    NOTE: Lubricate the gasket with clean engine oil.

    Position the new oil cooler, the new gasket and install the bolt.

    - Rotate the cooler clockwise until the locating pin hits the stop.
    - Tighten the bolt to 60 Nm (44 lb-ft).

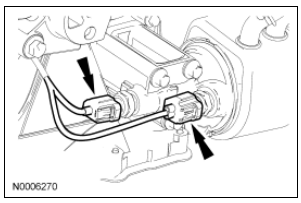


104. **NOTE:** Lubricate the gasket with clean engine oil.

    Install a new oil filter and tighten until the seal makes contact.

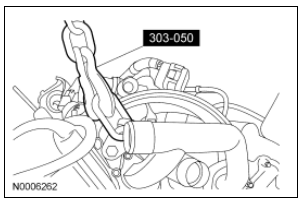
    - Using an oil filter strap wrench, tighten the filter an additional 270 degrees.

105. Connect the oil pressure and oil temperature sensor electrical connectors.

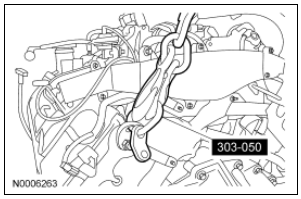


106. Install the engine block drain plug.
    - Tighten to 50 Nm (37 lb-ft).

107. Install the special tool.



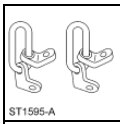
108. Install the special tool.



109. Install the engine lifting equipment and remove the engine from the stand.

Engine

Special Tool(s)

 ST1595-A	Lifting Brackets, Engine 303-050 (T70P-6000)
ST1602-A	Spreader Bar 303-D089 (D93P-6001-A3)
ST1293-A	Powertrain Lift With Tilting Plate 014-00765
ST1702-A	Transmission Support Bracket 014-00341

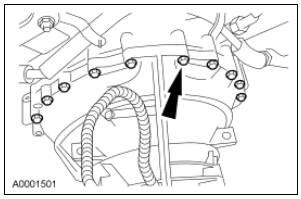
Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

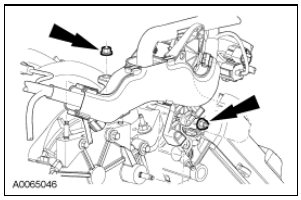
1. **NOTE:** Align the flexplate to converter marks made during engine removal.

   Install the engine to the transmission and install the bolts.

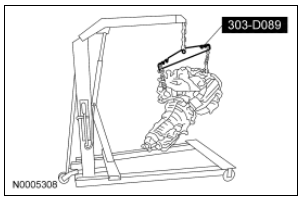
   - Tighten to 47 Nm (35 lb-ft).


A0001501

2. Position the wiring harness and install the 2 nuts.
   - Tighten to 10 Nm (89 lb-in).


A0065046

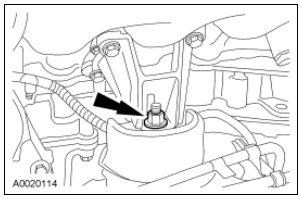
3. Using the special tool and an engine crane, move the engine and transmission onto the crossmember and cooling system assembly.



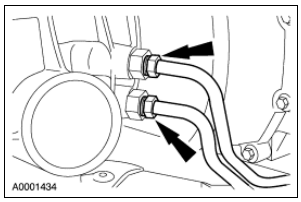
4. **NOTE:** LH shown, RH similar.

   Install the LH and the RH upper engine mount nuts.

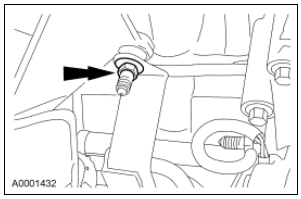
   - Tighten to 50 Nm (37 lb-ft).



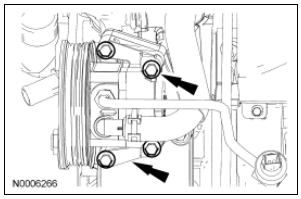
5. Connect the transmission cooler tubes.
   - Tighten to 35 Nm (26 lb-ft).



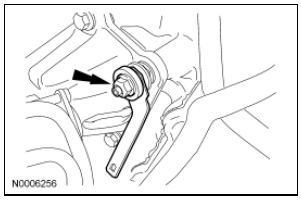
6. Install the transmission cooler tube bracket nut.
   - Tighten to 10 Nm (89 lb-in).



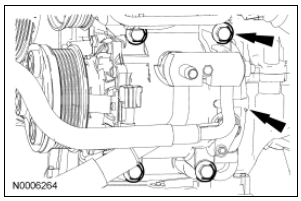
7. Install the power steering pump and 4 bolts.
   - Tighten to 25 Nm (18 lb-ft).



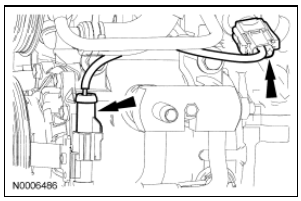
8. Install the power steering tube bracket nut.
   - Tighten to 18 Nm (13 lb-ft).



9. Install the A/C compressor and 4 bolts.
    - Tighten to 25 Nm (18 lb-ft).

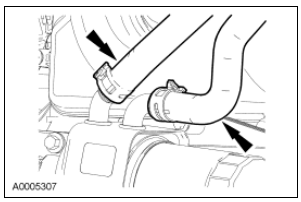


10. Connect the A/C compressor and power steering pressure (PSP) switch electrical connectors.

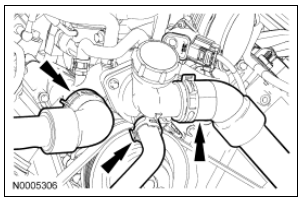


11. Install the accessory drive belt.

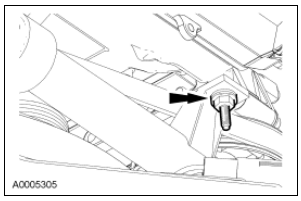
12. Connect the 2 oil cooler hoses, if equipped.



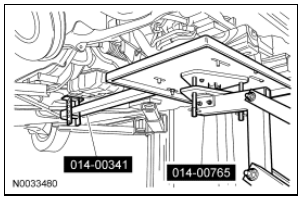
13. Connect the lower radiator, upper radiator and heater hose.



14. Install the lower radiator hose bracket nut.
    - Tighten to 10 Nm (89 lb-in).



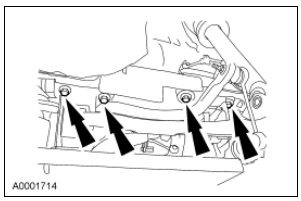
15. Using the powertrain lift and the transmission support bracket, carefully raise the entire assembly into the vehicle.



16. **NOTE:** LH shown, RH similar.

    Install the 4 front crossmember and the 4 center crossmember bolts.

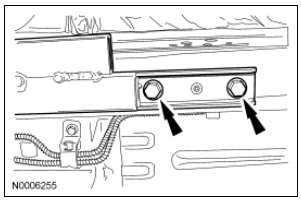
    - Tighten to 90 Nm (66 lb-ft).



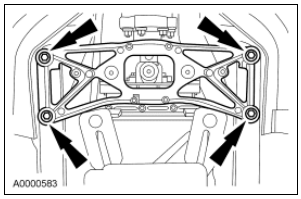
17. **NOTE:** RH shown, LH similar.

    Install the 4 RH and LH center crossmember I-brace bolts.

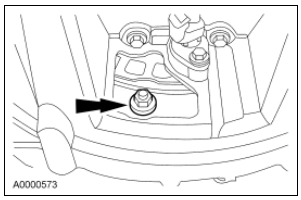
    - Tighten to 30 Nm (22 lb-ft).



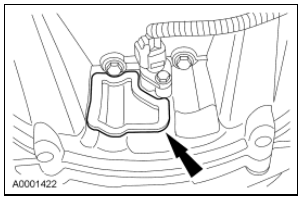
18. Install the 4 transmission support bolts.
    - Tighten to 55 Nm (41 lb-ft).



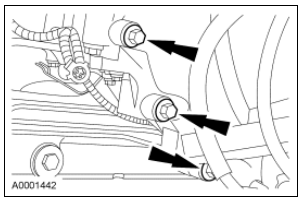
19. Install the 4 torque converter nuts.
    - Tighten to 48 Nm (35 lb-ft).



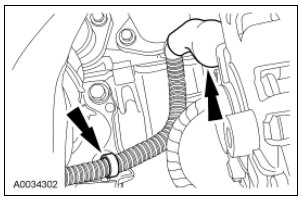
20. Install the cover.



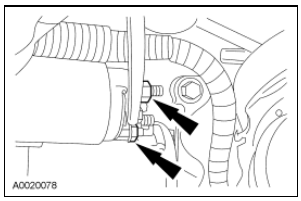
21. Install the 6 lower transmission to engine bolts.
    - Tighten to 47 Nm (35 lb-ft).



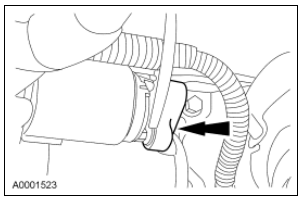
22. Connect the generator electrical connector and install the nut. Attach the pin-type retainer.
    - Tighten to 8 Nm (71 lb-in).



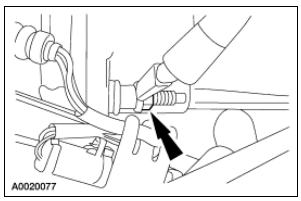
23. Connect the starter motor wiring and install the nuts.
    - Tighten the large nut to 12 Nm (9 lb-ft).
    - Tighten the small nut to 6 Nm (53 lb-in).



24. Install the cover.



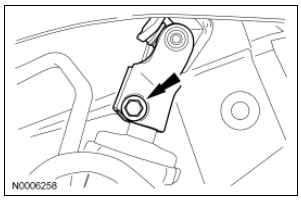
25. Install the starter motor ground cable and nut.
    - Tighten the large nut to 25 Nm (18 lb-ft).



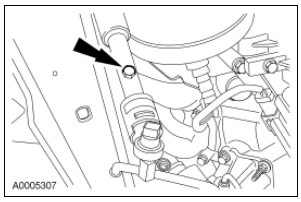
26. ⚠ **CAUTION: Do not allow the steering wheel to rotate while the steering column intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the wheel has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

    Connect the steering coupling and install the bolt.

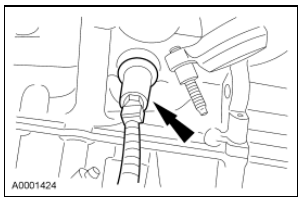
    - Tighten to 35 Nm (26 lb-ft).



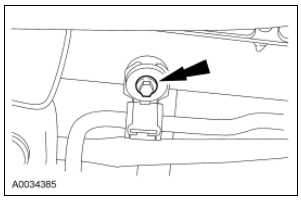
27. Install the steering shaft bolt.
    - Tighten to 30 Nm (22 lb-ft).



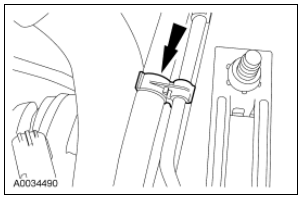
28. Connect the block heater electrical connector, if equipped.



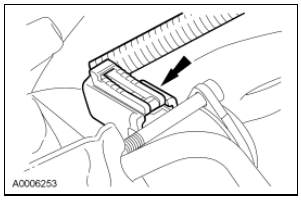
29. Install the retaining bolt for the high pressure power steering hose bracket.
    - Tighten to 10 Nm (89 lb-in).



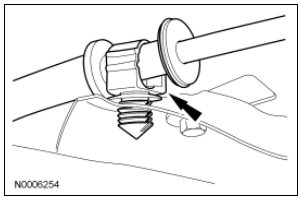
30. Attach the power steering return hose to the pressure hose clip.



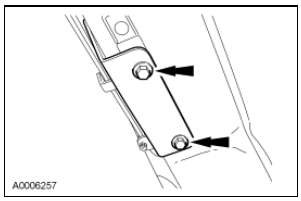
31. Connect the variable assist power steering (VAPS) actuator electrical connector.



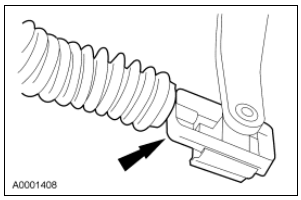
32. Attach the shift cable pin-type retainer to the exhaust heat shield.



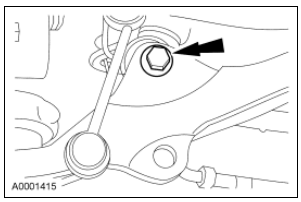
33. Install the shift cable bracket and 2 bolts.
    - Tighten to 10 Nm (89 lb-in).



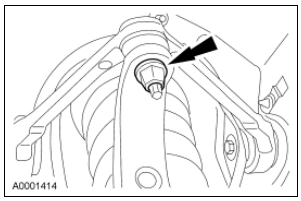
34. Connect the shift cable to the shifter.



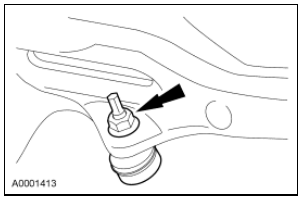
35. Install the 2 strut-to-control arm bolts and nuts.
    - Tighten to 175 Nm (129 lb-ft).



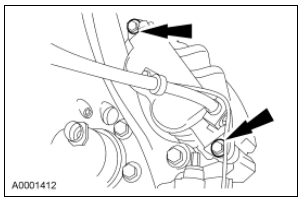
36. Position the upper ball joints into the wheel knuckles and install the 2 nuts.
    - Tighten to 90 Nm (66 lb-ft).



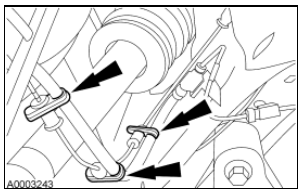
37. Position the stabilizer bar links into the lower control arms and install the 2 nuts.
    - Tighten to 55 Nm (41 lb-ft).



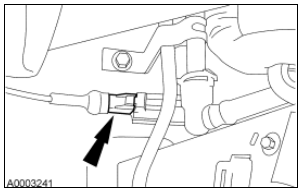
38. Install the front brake calipers and the 4 bolts.
    - Tighten to 35 Nm (26 lb-ft).



39. Attach the RH and LH anti-lock brake sensor harnesses to the brake hose clips.

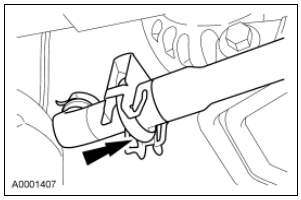


40. Connect the RH and LH anti-lock brake sensor electrical connectors.

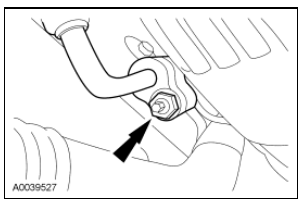


41. Install the RH and LH inner splash shields and pin-type retainers.

42. Connect the low pressure A/C hose.



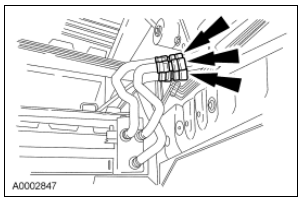
43. Connect the A/C high pressure hose and install the nut.
    - Tighten to 8 Nm (71 lb-in).



44. **NOTE:** The top heater hose has a green identifying mark to match the hose on the dual coolant flow valve. This will aid in the correct installation of the hose assemblies.

NOTE: Hose assemblies shown with components removed for clarity.

Connect the 3 heater hose quick release couplings. For additional information, refer to Section 412-00 .

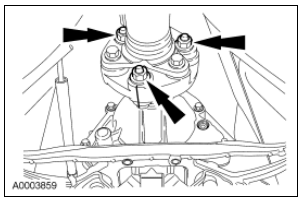


45. ⚠ **CAUTION: Install the bolts, washers and nuts in their original positions or driveshaft NVH can occur. Install the driveshaft flex coupling bolts with the head of the bolt seated against the flange and the nuts seated against the flex coupling.**

    NOTE: The bolt heads are serrated. Hold the bolt and tighten the nut.

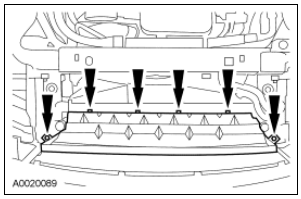
    Install the bolts, washers and nuts.

    - Coat the nut and bolt threads with sealer.
    - Tighten to 81 Nm (60 lb-ft).

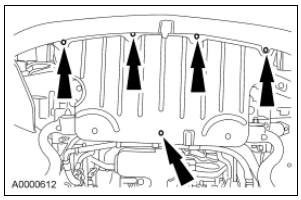


46. Install the catalytic converters. For additional information, refer to Section 309-00 .

47. Install the inner air deflector.

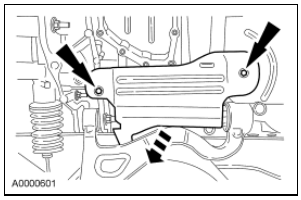


48. Install the center splash shield.

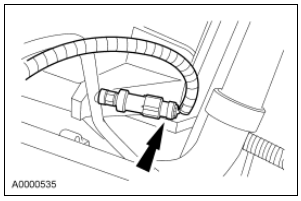


49. **NOTE:** LH shown, RH similar.

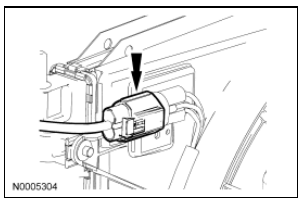
    Install the LH and the RH splash shields.



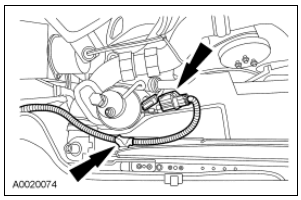
50. Connect the A/C pressure switch electrical connector.



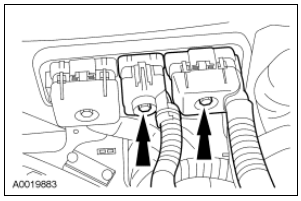
51. Connect the cooling fan electrical connector.



52. Connect the coolant valve electrical connector and attach the wiring harness clip to the radiator support.

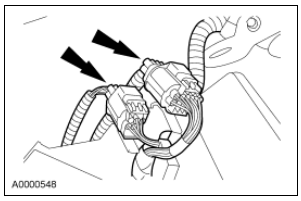


53. Connect the bulkhead electrical connectors.
    - Tighten to 6 Nm (53 lb-in).

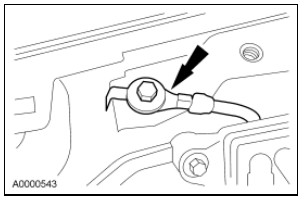


54. **NOTE:** The connectors are located on the backside of the RH strut tower.

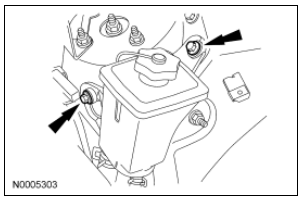
    Connect the engine wiring harness electrical connectors.



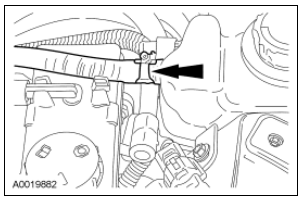
55. Position the ground strap and install the bolt.
    - Tighten to 10 Nm (89 lb-in).



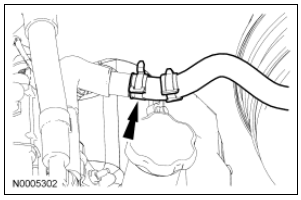
56. Install the power steering reservoir and 2 bolts.
    - Tighten the top bolt to 6 Nm (53 lb-in).
    - Tighten the bottom bolt to 12 Nm (9 lb-ft).



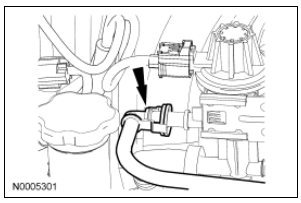
57. Connect the degas bottle hose.



58. Connect the vacuum hose.



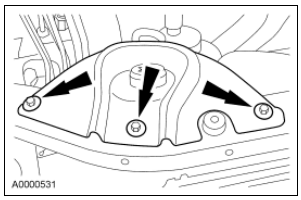
59. Connect the evaporative emissions (EVAP) hose to the EVAP canister purge valve.



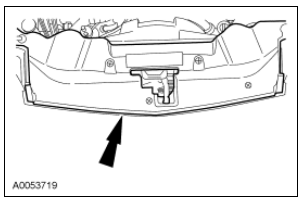
60. **NOTE:** RH shown, LH similar.

    Install the 2 upper radiator support brackets and the 6 bolts.

    - Tighten to 10 Nm (89 lb-in).



61. Install the upper radiator sight shield.



62. Connect the fuel supply tube. For additional information, refer to Section 310-00 .

63. Install the fresh air inlet duct. For additional information, refer to Section 412-01 .

64. Install the air cleaner assembly and outlet pipe. For additional information, refer to Section 303-12 .

65. Connect the battery ground cable. For additional information, refer to Section 414-01 .

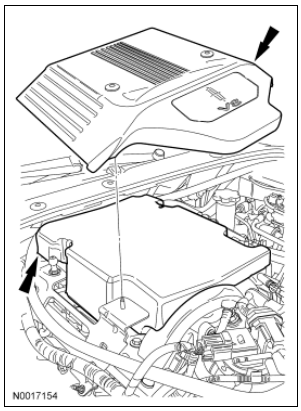
66. Fill the engine with clean engine oil.

67. ⚠ **CAUTION: The coolant fill procedure must be followed exactly or damage to the engine can occur.**

    Fill and bleed the engine cooling system. For additional information, refer to Section 303-03 .

68. ⚠ **CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

    Install the noise suppressor (if detached) and the engine appearance cover.



69. Evacuate and recharge the A/C system. For additional information, refer to Section 412-00 .

General Specifications

Item	Specification
Cooling System Capacity	**11.3L (3.0 gallons)**
Coolant Type	
Motorcraft Premium Gold Engine Coolant VC-7-A (in California, Oregon and New Mexico VC-7-B, in Canada CVC-7-A) or equivalent (yellow color) [a]	WSS-M97B51-A1
Other Chemicals	
Premium Cooling System Flush VC-1	ESR-M14P7-A
Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B
Cooling System Stop Leak Pellets VC-6	WSS-M99B37-B6
Pressure Tests	
Complete cooling system maximum pressure	Use the maximum specification listed on the pressure relief cap
Pressure relief cap	Use the specification listed on the pressure relief cap
Radiator (out of vehicle)	138 KPA (20 psi)
Thermostat Opening Temperatures	
Starts to open	86-90°C (187-194°F)
Fully open	104°C (219°F)

[a] The addition of Cooling System Stop Leak Pellets, VC-6, darkens Motorcraft Premium Gold Engine Coolant from yellow to golden tan.

Torque Specifications

Description	Nm	lb-ft	lb-in
Thermostat housing bolts	10	—	89
Upper radiator hose retaining bracket bolts	10	—	89
Coolant pump bolts [a]	—	—	—
Coolant pump pulley bolts [a]	—	—	—
Engine fill cap [a]	—	—	—
Coolant outlet pipe bolts	10	—	89
Receiver/drier bracket bolt	11	8	—
Coolant control valve bracket bolt	6	—	53
Auxiliary coolant pump bolts	9	—	80
Upper radiator support bracket bolts	10	—	89
Fan shroud bolts	10	—	89
Condenser-to-radiator bolts	10	—	89

Condenser support bracket bolts	10	—	89
Transmission oil cooler bolts	10	—	89
Degas bottle bolts	6	—	53
Cross vehicle support bolts	20	15	—

[a] Refer to the procedure in this section.

Engine Cooling

⚠ CAUTION: Vehicle cooling systems are filled with Motorcraft Premium Gold Engine Coolant VC-7-A (in California, Oregon and New Mexico VC-7-B, in Canada CVC-7-A) or equivalent meeting Ford specification WSS-M97B51-A1 (yellow color). Always fill the cooling system with the same coolant that is present in the system. Do not mix coolant types.

The cooling system components include the:

- block heater (optional).
- cylinder head temperature sensor.
- fan blade, fan motor and fan shroud assembly.
- radiator.
- pressure relief cap.
- degas bottle.
- radiator draincock.
- coolant pump.
- auxiliary coolant pump.
- oil cooler (optional).
- thermostat.

The thermostat:

- controls the engine coolant temperature.
- allows quicker engine warm-up.

The degas bottle:

- provides a location for system fill.
- contains coolant expansion and system pressurization.
- provides air separation during operation.
- replenishes the engine coolant to the system.

The fan blade draws air through the radiator to help cool the engine coolant.

The fan motor:

- operates only when the engine is running.

The engine coolant flows:

- from the lower radiator hose to the coolant pump.
- from the coolant pump to the engine block and the cylinder heads.

A closed thermostat returns the engine coolant to the coolant pump. An open thermostat allows the engine coolant to flow to the radiator.

Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the degas bottle.

When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.

To maintain the integrity of the cooling system:

- Add Motorcraft Premium Gold Engine Coolant VC-7-A (in California, Oregon and New Mexico VC-7-B, in Canada CVC-7-A) or equivalent meeting Ford specification WSS-M97B51-A1 (yellow color). Always fill the cooling system with the same coolant that is present in the system. Do not mix coolant types.
- Do not add/mix Motorcraft Speciality Orange Engine Coolant VC-2 or equivalent meeting Ford specification WSS-M97B44-D (orange color). Mixing coolants can degrade the coolant's corrosion protection.
- Do not add alcohol, methanol, brine or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- Do not mix with recycled coolant unless it meets the requirements of Ford specification WSS-M97B51-A1. Not all coolant recycling processes meet these Ford specifications. Use of such coolants can harm the engine and cooling system components. Do not mix coolant types.

The cylinder head temperature sensor provides a signal to the temperature gauge and will invoke fail-safe cooling.

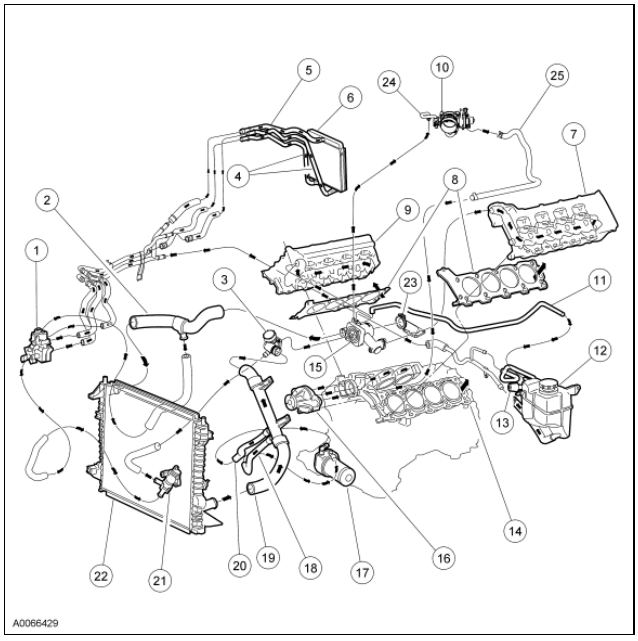
The optional block heater:

- electrical heating element is installed in the block cooling jacket.
    - ♦ uses a standard 110 V (220 V in Europe) electrical supply.
- keeps the engine coolant warm during cold weather.

The auxiliary coolant pump:

- provides heater coolant flow boost.
- has a secondary function of providing engine-off cooling.

Coolant Flow



Item	Part Number	Description
1	18495	Coolant control valve

2	8260	Upper radiator hose
3	8A520	Thermostat housing
4	18472	Heater inlet hoses (2 required)
5	18472	Heater outlet hose
6	18476	Heater core
7	6049	Cylinder head (LH)
8	6051	Cylinder head gaskets (2 required)
9	6049	Cylinder head (RH)
10	9E926	Throttle body
11	8276	Engine vent hose
12	8A080	Degas bottle
13	—	Relief valve
14	6009	Cylinder block
15	8A504	Coolant outlet pipe
16	8501	Coolant pump
17	6A642	Oil cooler
18	—	Oil cooler inlet hose
19	8286	Lower radiator hose
20	—	Oil cooler outlet hose
21	18D794	Auxiliary coolant pump
22	8005	Radiator
23	9N499	Coolant outlet pipe
24	8548	Throttle heating feed hose
25	9F814	Throttle heating hose

Engine Cooling

Special Tool(s)

ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
ST1720-A	Coolant/Battery Refractometer 023-00164 or equivalent
ST1474-A	Pressure Test Kit 014-R1072 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware or equivalent scan tool

Material

Item	Specification
Motorcraft® Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

Principles of Operation

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. The coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine-generated heat to the outside air.

The degas bottle holds surplus coolant and removes air from the cooling system, which reduces hot spots. It also allows for coolant expansion and system pressurization, replenishes coolant to the cooling system and serves as the location for service fill.

The cooling fan draws air through the radiator to help cool the system coolant as it passes through the radiator.

The thermostat monitor is a function of the PCM and is designed to verify correct thermostat operation. The monitor will be executed once per drive cycle and has a monitor run duration of 300-800 seconds. If a malfunction occurs, DTC P0125 or P0128 is set, and the Malfunction Indicator Lamp (MIL) will be

illuminated.

For vehicle/engine specific information, refer to Engine Cooling in the Description and Operation portion of this section.

Inspection and Verification

⚠ **WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

NOTICE: **The engine cooling system is filled with Motorcraft Premium Gold Engine Coolant. Mixing coolant types degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant. Do not mix coolant types. Failure to follow these instructions may result in engine or cooling system damage.**

NOTE: Vehicles have the pressure relief cap on the degas bottle and no radiator cap.

1. Verify the customer concern.
2. Visually check the engine coolant level at the degas bottle when the system is cold.
3. Make sure the pressure relief cap is installed correctly.
4. Record any cooling system DTCs retrieved. Refer to the PCM DTC chart in this section for DTC descriptions.
5. **NOTE:** Take note of any coolant odor or steam coming from cooling system components.

   If the system coolant is filled correctly and no DTCs associated with fail-safe cooling are retrieved, verify the customer's concern by operating the engine to duplicate the condition.
6. Inspect to determine if any of the following mechanical or electrical concerns apply.

Visual Inspection Chart

Mechanical	Electrical
• Leaks or weeps at: ♦ Hoses ♦ Tubes ♦ Clamp joints ♦ Quick connect couplings (if equipped) ♦ Gaskets ♦ O-rings ♦ Thermostat housing ♦ Radiator ♦ Pressure relief cap ♦ Coolant pump	• Inoperative or damaged: ♦ Electric cooling fan ♦ Wiring, connectors, relays or modules ♦ Cylinder Head Temperature (CHT) sensor ♦ Mass Air Flow (MAF) sensor ♦ Vehicle Speed Sensor (VSS)

♦ Heater core (wet floor or coolant odor in vehicle) ♦ Coolant crossover manifold assembly (if equipped) ♦ Oil cooler (if equipped) ♦ Degas bottle ♦ Cylinder block core plugs ♦ Cylinder head core plugs ♦ Block heater (if equipped) ♦ Auxiliary coolant pump ♦ Coolant control valve	

Visual Inspection Chart

Mechanical	Electrical
• Cracked or damaged: ♦ Hoses ♦ Tubes ♦ Hose clamps ♦ Thermostat housing ♦ Radiator ♦ Pressure relief cap ♦ Cooling fan ♦ Coolant pump ♦ Degas bottle ♦ Oil cooler (if equipped) ♦ Coolant crossover manifold assembly (if equipped) ♦ Cylinder block core plugs ♦ Cylinder head core plugs ♦ Block heater (if equipped) ♦ Auxiliary coolant pump ♦ Coolant control valve • Restricted airflow through the A/C condenser/radiator • Drive belt loose, worn or installed incorrectly • Broken or weak drive belt tensioner • Excessive white or light gray exhaust smoke (may have burnt coolant odor) • Coolant in engine oil • Engine oil in coolant	â—

7. If the inspection reveals an obvious concern that can be readily identified, repair it as necessary. Test the system for normal operation.

8. Inspect the coolant condition in the following sequence:
    1. Inspect the coolant color.
        - ♦ If Motorcraft Premium Gold Engine Coolant has a clear or pale yellow color, this indicates higher water content than required. Test the engine coolant freezing point range with the Coolant/Battery Refractometer. The freezing point should be in the range -45°C to -23°C (-50°F to -10°F). If the vehicle is driven in cold climates less

than -36°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50 ethylene glycol to distilled water.

- A pale green color indicates incorrect coolant (green in color) may have been added to the system. Use of incorrect (green in color) coolant degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.
- **NOTE:** If Cooling System Stop Leak Pellets are used, darkening of the Motorcraft Premium Gold Engine Coolant from yellow to golden tan will occur.

  Dark brown could indicate a commercially available stop leak may have been used. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.
- A light or reddish brown color indicates that rust may be present in the cooling system. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.
- An iridescent sheen on top of the coolant could indicate a trace of oil is entering the system. For information on engine diagnosis, refer to Section 303-00 .
- A milky brown color may indicate that engine oil is entering the cooling system. Pressure test the cooling system. Refer to Component Tests in this section. If engine oil is suspected, the cause of the leak may be internal to the engine. Refer to Section 303-00 .

2. If the engine coolant appearance is acceptable, test the engine coolant freezing point range with the Coolant/Battery Refractometer. The freezing point should be in the range -45°C to -23°C (-50°F to -10°F). If the vehicle is driven in cold climates less than -36°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
   - Maximum coolant concentration is 60/40 for cold weather areas.
   - Minimum coolant concentration is 40/60 for warm weather areas.
3. Adjust coolant range and level if necessary:
   - If coolant is low, add specified coolant mixture only.
   - If the engine coolant tests too weak, remove some of the engine coolant and add undiluted engine coolant until the readings are within acceptable levels.
   - If the engine coolant tests strong, remove some of the engine coolant and add distilled water until the readings are within acceptable levels.

9. If an obvious cause for an observed or reported concern is found, correct the cause and test the system for normal operation before proceeding to the next step.

10. **NOTE:** Make sure to use the latest scan tool software release.

    If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

11. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

    If the scan tool does not communicate with the VCM :

    - check the VCM connection to the vehicle.
    - check the scan tool connection to the VCM .
    - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

12. If the scan tool does not communicate with the vehicle:

- verify the ignition key is in the ON position.
- verify the scan tool operation with a known good vehicle.
- refer to Section 418-00 to diagnose no response from the PCM.

13. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record continuous memory DTCs.

14. Clear the continuous DTCs and carry out the self-test diagnostics PCM.

15. If the DTCs recovered are related to the concern, go to the PCM DTC Chart. For all other DTCs, refer to Section 419-10 .

16. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Chart

PCM DTC Chart

DTC	Description	Action
P0217	Engine Coolant Overtemperature Condition	GO to Pinpoint Test B .
P1285	Cylinder Head Overtemperature Condition	GO to Pinpoint Test B .
P1299	Cylinder Head Overtemperature Protection Active	GO to Pinpoint Test B .
P0125	Insufficient Coolant Temp For Closed Loop Fuel Control	GO to Pinpoint Test C .
P0128	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	GO to Pinpoint Test C .
P0480 P0481 P0482	Fan 1, 2 or 3 Control Circuit, Respectively	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
All Other DTCs	—	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: Loss of Coolant

Normal Operation

The engine cooling system is a closed system that provides for coolant expansion and contraction and also changes in pressure as coolant warms and cools with engine operation. Various gaskets, seals, hoses and clamps are used to contain coolant within the cooling system and keep other fluids and contaminants from entering the cooling system.

Coolant loss can be attributed to either external or internal leaks anywhere within the cooling system.

For vehicle/engine specific information, refer to Engine Cooling in the Description and Operation portion of this section.

This pinpoint test is intended to diagnose the following:

- Coolant hoses or tubes
- Hose clamps
- Thermostat O-ring seal or gasket
- Coolant pump O-ring seal or gasket
- Thermostat housing
- Radiator
- Pressure relief cap
- Coolant pump leaking from weep hole
- Heater core
- Coolant crossover manifold assembly (if equipped)
- Engine gaskets
- Oil cooler (if equipped)
- Degas bottle
- Cylinder block core plugs
- Cylinder head core plugs
- Block heater (if equipped)
- Auxiliary coolant pump
- Coolant control valve

PINPOINT TEST A: LOSS OF COOLANT

⚠ **WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

Test Step	Result / Action to Take
A1 CARRY OUT INSPECTION AND VERIFICATION	
• Carry out the Inspection and Verification procedure in this section. • **Were any concerns found?**	**Yes** REPAIR as needed. TEST the system for normal operation. **No** GO to A2 .
A2 CHECK THE ENGINE COOLANT LEVEL	
NOTE: Allow the engine to cool before checking the engine coolant level.	**Yes** GO to A3 . **No**

• Ignition OFF. • Visually inspect the engine coolant level at the degas bottle. • **Is the engine coolant level within specifications?**	ADJUST the engine coolant level as necessary. GO to A3 .
A3 PRESSURE TEST THE ENGINE COOLING SYSTEM	
• Pressure test the engine cooling system. Refer to Component Tests, Cooling System Pressure Test in this section. • **Does the engine cooling system leak?**	**Yes** REPAIR or INSTALL new components. TEST the system for normal operation. **No** GO to A4 .
A4 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK	
• Inspect the engine coolant in the degas bottle for signs of engine oil. • **Is engine oil evident in the coolant?**	**Yes** GO to Section 303-00 for engine diagnosis. **No** GO to A5 .
A5 CHECK THE ENGINE OIL FOR COOLANT	
• Remove the oil level indicator from the engine. • **Is coolant evident in the oil?**	**Yes** GO to Section 303-00 for engine diagnosis. **No** GO to A6 .
A6 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES	
• **NOTE:** Use U-View® Combustion Leak Tester, part No. 560000 or equivalent. • Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases. • **Are combustion gases present?**	**Yes** GO to Section 303-00 for engine diagnosis. **No** The cooling system is operational.

Pinpoint Test B: The Engine Overheats

Normal Operation

The engine cooling system functions to maintain engine temperatures during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. The coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator

circuit in order to transfer engine-generated heat to the outside air.

Engine overheating generally occurs when there is a disruption in the ability to control either coolant flow at the correct rate, the inability to transfer heat from the engine through the coolant (including low coolant) or an inability to transfer engine-generated heat to the outside air through the radiator.

For vehicle/engine specific information, refer to Engine Cooling in the Description and Operation portion of this section.

- DTC P0217 Engine Coolant Overtemperature Condition
- DTC P1285 Cylinder Head Overtemperature Condition
- DTC P1299 Cylinder Head Overtemperature Protection Active

This pinpoint test is intended to diagnose the following:

- Low coolant level
- External engine coolant leak
- Airlock in system
- Pressure relief cap installation
- Restricted airflow through the A/C condenser/radiator
- Internal engine coolant leak
- Coolant condition/concentration
- Accessory drive components
- Non-OEM engine enhancement components
- Electric cooling fan
- Engine Coolant Temperature (ECT) indicator system (gauge)
- Cylinder Head Temperature (CHT) sensor (if equipped)
- Heater core
- Coolant pump
- Coolant flow restriction

PINPOINT TEST B: THE ENGINE OVERHEATS

⚠ WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

Test Step	Result / Action to Take
B1 CARRY OUT INSPECTION AND VERIFICATION	
• Carry out the Inspection and Verification procedure in this section. • **Were any concerns found?**	**Yes** REPAIR as needed. TEST the system for normal operation. **No** GO to B2 .
B2 CHECK FOR DTCs	
• **NOTE:** Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for correct scan tool hook-up procedure.	**Yes** GO to B3 . **No** Actual engine overheating has not been verified. CHECK

• Check for DTC P0217, P1285 or P1299. • **Is DTC P0217, P1285 or P1299 present?**	the ECT gauge operation. REFER to Section 413-01 . If any other DTCs are retrieved, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B3 CHECK FOR AN AIRFLOW OBSTRUCTION	
• Check the radiator or A/C condenser for an external obstruction such as leaves or cardboard. • **Is an obstruction present?**	**Yes** REMOVE the obstruction. TEST the system for normal operation. **No** GO to B4 .
B4 CHECK THE ENGINE COOLANT LEVEL	
NOTE: Allow the engine to cool before checking the coolant level. • Ignition OFF. • Visually check the engine coolant level in the degas bottle. • **Is the engine coolant level within specification?**	**Yes** GO to B5 . **No** ADJUST the engine coolant level as necessary. GO to B5 .
B5 PRESSURE TEST THE ENGINE COOLING SYSTEM	
• Pressure test the engine cooling system. Refer to Component Tests, Cooling System Pressure Test in this section. • **Does the engine cooling system leak?**	**Yes** REPAIR or INSTALL new components. TEST the system for normal operation. **No** GO to B6 .
B6 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK	
• Inspect the engine coolant in the degas bottle for signs of engine oil. • **Is engine oil evident in the coolant?**	**Yes** GO to Section 303-00 for engine diagnosis. **No** GO to B7 .
B7 CHECK THE ENGINE OIL FOR COOLANT	
• Remove the oil level indicator from the engine. • **Is coolant evident in the engine oil?**	**Yes** GO to Section 303-00 for engine diagnosis. **No** GO to B8 .
B8 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES	
• **NOTE:** Use U-View® Combustion Leak Tester, part No. 560000 or	**Yes** GO to Section 303-00 for engine diagnosis.

equivalent. • Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases. • **Are combustion gases present?**	**No** GO to B9 .
B9 CHECK COOLANT CONDITION	
• Check the coolant for dirt, rust or contamination and check the coolant concentration. • **Is the coolant condition OK?**	**Yes** GO to B10 . **No** FLUSH the engine cooling system. REFER to Cooling System Flushing in this section. TEST the system for normal operation.
B10 CHECK THE ELECTRIC COOLING FAN OPERATION	
• Start the engine. • Place the climate control function selector in the MAX A/C position and the blower motor switch in the HI position. • **Did the electric cooling fan operate?**	**Yes** GO to B11 . **No** DIAGNOSE the electric cooling fan operation. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B11 CHECK THE COOLANT PUMP OPERATION	
• Start the engine. • Allow the engine to run for 30 minutes. Place the climate control function selector in the MAX HEAT position. Feel the heater outlet hose. • **Is the heater outlet hose hot?**	**Yes** GO to B12 . **No** INSTALL a new coolant pump. TEST the system for normal operation.
B12 CHECK THE THERMOSTAT OPERATION	
• Start the engine. • Allow the engine to run for 30 minutes. Feel the lower radiator hose. • **Is the lower radiator hose hot?**	**Yes** CHECK the engine coolant temperature gauge operation. REFER to Section 413-01 . **No** GO to B13 .
B13 VISUALLY INSPECT THE THERMOSTAT	
• Carry out the Thermostat Visual Inspection in the Component Tests portion of this section. • **Is the thermostat damaged?**	**Yes** INSTALL a new thermostat. TEST the system for normal operation. **No** INSTALL a new thermostat. TEST the system for normal operation. If the engine still overheats, INSTALL a new

	radiator. TEST the system for normal operation.

Pinpoint Test C: The Engine Does Not Reach Normal Operating Temperature

Normal Operation

The engine cooling system functions to maintain engine temperatures during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. The coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

Concerns of engine inability to reach normal operating temperature typically occur when the rate of coolant flow through some coolant circuits (radiator, heater core) is more than expected given the conditions, or when the cooling fans operate all the time. Heat is not allowed to build in the engine because a heat exchanger is removing too much heat, including the radiator, heater core and oil cooler. In addition, perceived concerns that the engine does not reach normal operating temperature can be related to a low coolant level or trapped air which does not allow for hot coolant to be available at the heater core, an inoperative climate control system, or for concerns perceived or related to an incorrect engine temperature gauge indication.

For vehicle/engine specific information, refer to Engine Cooling in the Description and Operation portion of this section.

- DTC P0125 Insufficient Coolant Temp for Closed Loop Fuel Control
- DTC P0128 Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)

This pinpoint test is intended to diagnose the following:
- Low coolant level
- Thermostat
- Engine Coolant Temperature (ECT) indicator system (gauge)
- Engine cooling fan

PINPOINT TEST C: THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

⚠ **WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

Test Step	Result / Action to Take
C1 CARRY OUT INSPECTION AND VERIFICATION	
	Yes REPAIR as needed. TEST the system for normal operation.

• Carry out the Inspection and Verification procedure in this section. • **Were any concerns found?**	**No** GO to C2 .
C2 CHECK FOR DTCs P0125 or P0128	
NOTE: Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for correct scan tool hook-up procedure. • Check for DTC P0125 or P0128. • **Is DTC P0125 or P0128 present?**	**Yes** GO to C3 . **No** The cooling system is operational. If an inoperative engine coolant temperature gauge is suspected, CHECK the engine coolant temperature gauge operation. REFER to Section 413-01 . If an inoperative climate control system is suspected, CHECK the climate control system operation. REFER to Section 412-00 . If any other DTCs are retrieved, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
C3 CHECK THE ELECTRIC COOLING FAN OPERATION	
• Allow the engine to cool. • Make sure the A/C switch is OFF. • Start the engine. • Check the electric cooling fan. • **Is the electric cooling fan on all the time?**	**Yes** DIAGNOSE the electric cooling fan operation. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to C4 .
C4 CHECK THE COOLANT LEVEL	
• **NOTE:** Allow the engine to cool before checking the coolant level. • Visually check the engine coolant level in the degas bottle. • **Is the engine coolant level within specification?**	**Yes** INSTALL a new thermostat. TEST the system for normal operation. **No** GO to Pinpoint Test A to diagnose a coolant leak.

Component Tests

Cooling System Pressure Test

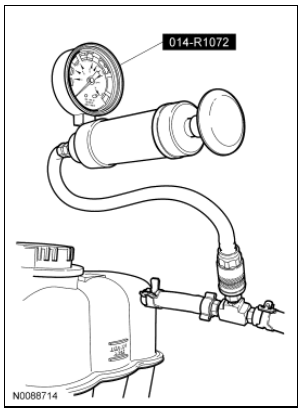
⚠ **WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

NOTE: Vehicles have the pressure relief cap on the degas bottle and no radiator cap.

1. Turn the engine OFF.

2. Check the engine coolant level. Adjust the coolant level as necessary.

3. Attach the Pressure Test Kit to the degas bottle nipple and overflow hose. Install a pressure test pump to the quick connect fitting of the test adapter.



4. ***NOTICE:*** **Do not pressurize the cooling system beyond the maximum pressure listed in the specifications table in this section or cooling system components may be damaged.**

   NOTE: If the plunger of the pressure tester is depressed too fast, an erroneous pressure reading will result.

   Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing and note the highest pressure reading obtained. If the pressure reading exceeds the maximum cap pressure listed in the specifications table, install a new pressure relief cap.

5. If the system does not hold pressure, remove the pressure relief cap and wash in clean water to dislodge all the foreign material from the gasket. Check the sealing surface in the filler neck of the degas bottle for nicks or cuts. Install the pressure relief cap.

6. Pressurize the engine cooling system as described in Step 4 above. Observe the gauge reading for approximately 2 minutes. Pressure should not drop during this time. If the pressure drops within this time, inspect for leaks and repair as necessary.

7. If no leaks are found and the pressure drops, the pressure relief cap may be leaking. Install a new pressure relief cap and retest the system.

8. If no leaks are found after a new pressure relief cap is installed, and the pressure drops, the leak may be internal to the engine. Inspect the coolant for engine oil and the engine oil for coolant. Refer to Section 303-00 to diagnose the engine.

9. Release the system pressure by loosening the pressure relief cap. Check the coolant level and adjust as necessary.

Thermostat

A new thermostat should be installed only after the following tests and checks have been carried out:

- Pinpoint Test A, B or C
- Thermostat Visual Inspection

Thermostat Visual Inspection

1. Remove the thermostat.

2. Examine the thermostat for signs of damage including:
   - Valve not fully seated (light visible through the valve)
   - Foreign material lodged in the main valve
   - Bent or broken frame or flange
   - Bent or broken spring
   - Bent or broken valve or valve stem
   - Wax leaking from wax reservoir or a bulge in the reservoir
   - Any other damage or distortion

3. **NOTE:** If no damage is found during the inspection, do not attempt to open the thermostat using hot water or other heat sources. This method is not an accurate means to test the function of the thermostat and may damage the thermostat.

   If damage is found during the inspection, remove any foreign material or broken pieces and install a new thermostat.

4. If no damage is found during the inspection, continue troubleshooting the system concern. Go to the Symptom Chart for further instructions.

Radiator Leak Test, Removed From Vehicle

NOTICE: **Never leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the cleaning tank and they will damage aluminum radiators.**

NOTE: Clean the radiator before leak testing to avoid contamination of tank.

1. Leak test the radiator in clean water with pressurized air to the maximum pressure listed in the Specifications.

Cooling System Draining, Filling and Bleeding

Special Tool(s)

ST2618-A	RADIATOR REFILLER 078-00592

Draining

⚠ WARNING: Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or personal injury. To avoid having scalding hot coolant or steam blow out of the degas bottle when removing the pressure relief cap, wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap.

NOTICE: **The coolant must be recovered in a suitable, clean container for reuse. If the coolant is contaminated it must be recycled or disposed of correctly.**

NOTICE: **Care must be taken to make sure the accessory drive belt does not become contaminated with engine coolant.**

NOTICE: **Vehicle cooling systems are filled with Motorcraft Premium Gold Engine Coolant VC-7-A (in California, Oregon and New Mexico VC-7-B, in Canada CVC-7-A) or equivalent meeting Ford specification WSS-M97B51-A1 (yellow color). Always fill the cooling system with the same coolant that is present in the system. Do not mix coolant types.**

1. Wrap a thick cloth around the coolant pressure relief cap on the degas bottle. Slowly turn the cap counterclockwise (left) until the pressure begins to release. When the pressure is released, remove the pressure relief cap.

2. **NOTE:** Less than 80% of coolant can be recovered with the engine in the vehicle. Dirty, rusty or contaminated coolant requires replacement.

   Place a suitable container below the radiator draincock. If equipped, disconnect the coolant return hose at the oil cooler.

   - Close the radiator draincock when finished.

Filling and Bleeding With RADIATOR REFILLER

1. Install the RADIATOR REFILLER and follow the manufacturer's instructions to fill and bleed the cooling system.
   - Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
     - ♦ Maximum coolant concentration is 60/40 for cold weather areas.
     - ♦ Minimum coolant concentration is 40/60 for warm weather areas.

Filling and Bleeding Without RADIATOR REFILLER

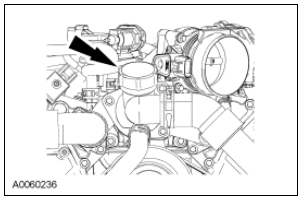
⚠ WARNING: Do not open the cooling system while it is hot or the engine is running. Failure to follow these instructions can result in personal injury.

NOTICE: **Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the degas bottle.**

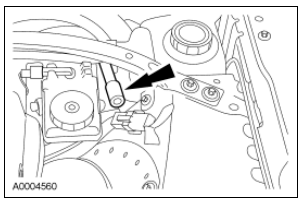
To maintain the integrity of the coolant and the cooling system:

- Add Motorcraft Premium Gold Engine Coolant VC-7-A (in California, Oregon and New Mexico VC-7-B, in Canada CVC-7-A) or equivalent meeting Ford specification WSS-M97B51-A1 (yellow color). Use the same coolant that was drained from the cooling system. Do not mix coolant types.
- Do not add Motorcraft Speciality Orange Engine Coolant VC-2 meeting Ford specification WSS-M97B44-D (orange color). Mixing coolants can degrade the coolant's corrosion protection.
- Do not add alcohol, methanol, brine or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- Do not mix recycled coolant unless it meets the requirements of Ford specification WSS-M97B51-A1. Not all coolant recycling processes meet these Ford specifications. Use of such coolants can harm the engine and cooling system components.

1. Remove the engine fill cap.



2. Open the heater air bleed.



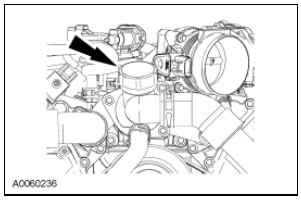
3. Add coolant to the degas bottle allowing the system to equalize until no more coolant can be added.
    - Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
        - ♦ Maximum coolant concentration is 60/40 for cold weather areas.
        - ♦ Minimum coolant concentration is 40/60 for warm weather areas.

4. Install the degas bottle cap.

NOTICE: **Care must be taken to make sure the accessory drive belt does not become contaminated with engine coolant.**

5. Add as much coolant as possible to the engine fill. The heater air bleed will remain open.

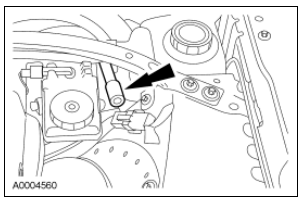
6. Install the engine fill cap.
    - Install the engine fill cap until contact is made and then tighten an additional 45 degrees (1/8 turn).



7. **NOTE:** The heater air bleed remains open.

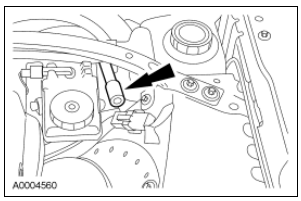
   Start the engine and turn the heater to the defrost (90°F) position.

8. Close the heater air bleed when a steady stream of coolant escapes during engine idle.



9. Allow the engine to idle for 5 minutes, add coolant to the degas bottle as needed to maintain the cold fill MAX mark.

10. Reopen the heater air bleed to release any trapped air and close again.



11. Maintain engine speed of 2,000 rpm for 3-5 minutes or until hot air comes from the heater.

12. Return to idle and verify hot air is still coming from the heater.

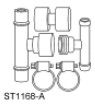
13. Set the heater temperature setting to 24°C (75°F) and allow the vehicle to idle for 2 minutes.

14. Shut the engine off and allow to cool.

15. After the engine has cooled, add coolant to the degas bottle to bring the level to the cold fill MAX mark.

Cooling System Flushing

Special Tool(s)

 ST1168-A	Flush Kit 164-R3658 or equivalent
ST1167-A	Drain Kit 164-R3662 or equivalent
ST2421-A	Pro Flush and Fill, Coolant 023-00154 or equivalent

Material

Item	Specification
Premium Cooling System Flush VC-1	ESR-M14P7-A

1. ⚠ **WARNING: Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or personal injury. To avoid having scalding hot coolant or steam blow out of the degas bottle when removing the pressure relief cap, wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap.**

   Once pressure is released, remove the pressure relief cap.

2. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

3. Remove the thermostat. For additional information, refer to Thermostat in this section.

4. Install the hose connection without the thermostat.

5. **NOTE:** Refer to the cooling system Pro Flush and Fill operating instructions for specific vehicle hook-up.

   Use cooling system Pro Flush and Fill, Coolant Flush Kit and Drain Kit to flush the engine and radiator.

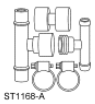
6. Install the thermostat. For additional information, refer to Thermostat in this section.

7. Backflush the heater core. For additional information, refer to Heater Core Backflushing in this section.

8. Fill the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Heater Core Backflushing

Special Tool(s)

 ST1168-A	Flush Kit 164-R3658 or equivalent
ST1167-A	Drain Kit 164-R3662 or equivalent
ST2421-A	Pro Flush and Fill, Coolant 023-00154 or equivalent

Material

Item	Specification
Premium Cooling System Flush VC-1	ESR-M14P7-A

1. ⚠ **WARNING: Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or personal injury. To avoid having scalding hot coolant or steam blow out of the degas bottle when removing the pressure relief cap, wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap.**

   Once pressure is released, remove the pressure relief cap.

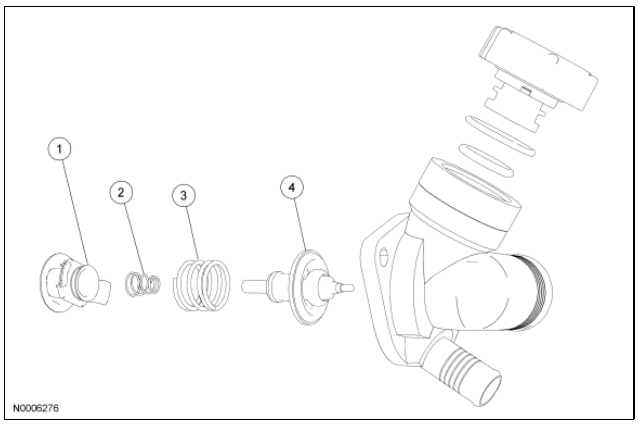
2. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

3. **NOTE:** Refer to the cooling system Pro Flush and Fill operating instructions for specific vehicle hook-up.

   Use cooling system Pro Flush and Fill, Flush Kit and Drain Kit to backflush the heater core.

4. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Thermostat



Item	Part Number	Description
1	—	Thermostat-to-thermostat housing retainer (part of 8575)
2	—	Thermostat spring (part of 8575)
3	—	Thermostat main spring (part of 8575)
4	—	Thermostat element (part of 8575)

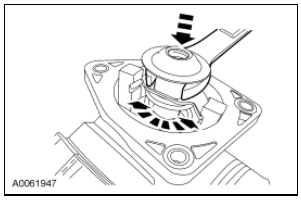
Removal

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the thermostat housing. For additional information, refer to Thermostat Housing in this section.

3. **NOTE:** Thermostat can be rotated in either direction to release it from the thermostat housing.

   Using a 18 mm (0.7 in) open end wrench, simultaneously push down and turn the thermostat retainer to release it from the housing.



4. Remove the thermostat spring, thermostat main spring and the thermostat element.

Installation

1. ⚠ **CAUTION: When installing the thermostat into the thermostat housing, make sure to align the thermostat pin with the hole in the housing.**

   Position the thermostat into the thermostat housing.

   - Be sure to install the small end of the thermostat spring toward the thermostat housing.

2. ⚠ **CAUTION: After installing the thermostat into the thermostat housing, make sure that the tabs on the thermostat retainer are locked into the tabs on the thermostat housing.**

   NOTE: The thermostat can be rotated in either direction to install it in the thermostat housing.

   Using an 18 mm (0.7 in) open end wrench, simultaneously push down and turn the thermostat retainer to install the thermostat in the housing.

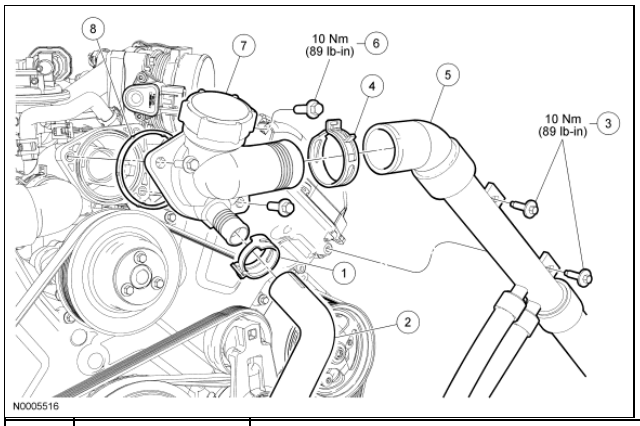
3. Install the thermostat housing. For additional information, refer to Thermostat Housing in this section.

4. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Thermostat Housing

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant VC-7-A (in California, Oregon and New Mexico VC-7-B, in Canada CVC-7-A) or equivalent (yellow color)	WSS-M97B51-A1



Item	Part Number	Description
1	15161	Auxiliary coolant pump-to-thermostat housing hose clamp
2	18K580	Auxiliary coolant pump-to-thermostat housing hose
3	W503925	Lower radiator hose support bracket bolts (2 required)
4	15161	Lower radiator-to-thermostat housing hose clamp
5	8B273	Lower radiator-to-thermostat housing hose
6	W500014	Thermostat housing bolts (3 required)
7	8594	Thermostat housing
8	8A571	Thermostat housing O-ring seal

Removal and Installation

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

3. Disconnect the auxiliary coolant pump-to-thermostat housing hose and position aside.

4. Remove the 2 lower radiator hose support bracket bolts.
   - To install, tighten to 10 Nm (89 lb-in).

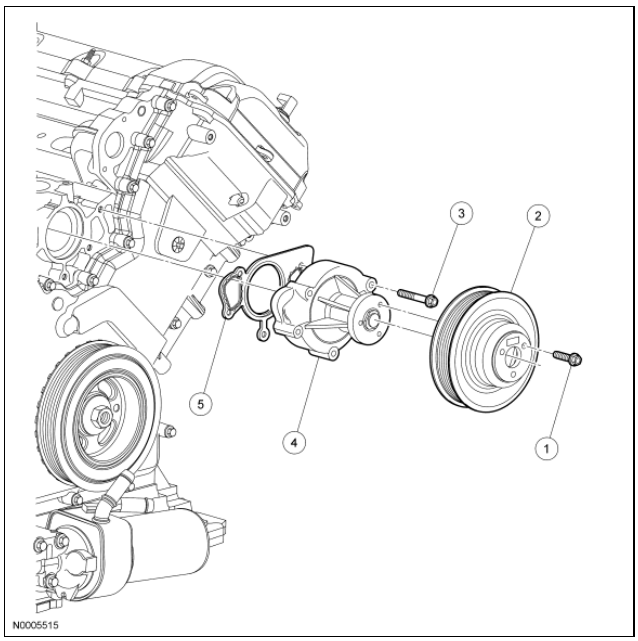
5. Disconnect the lower radiator-to-thermostat housing hose and position aside.

6. Remove the 3 bolts and the thermostat housing.
    - Discard the thermostat housing O-ring seal.
    - To install, tighten to 10 Nm (89 lb-in).

7. To install, reverse the removal procedure.
    - Install a new thermostat housing O-ring seal and lubricate with clean engine coolant.

8. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Coolant Pump



Item	Part Number	Description
1	W705629	Coolant pump pulley bolt (3 required)
2	8509	Coolant pump pulley
3	W500304	Coolant pump bolt (5 required)
4	8501	Coolant pump
5	8507	Coolant pump gasket

Removal and Installation

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the thermostat housing. For additional information, refer to Thermostat Housing in this section.

3. Loosen the coolant pump pulley bolts.
   - Do not remove at this time.

4. Remove the accessory drive belt. For additional information, refer to Section 303-05 .

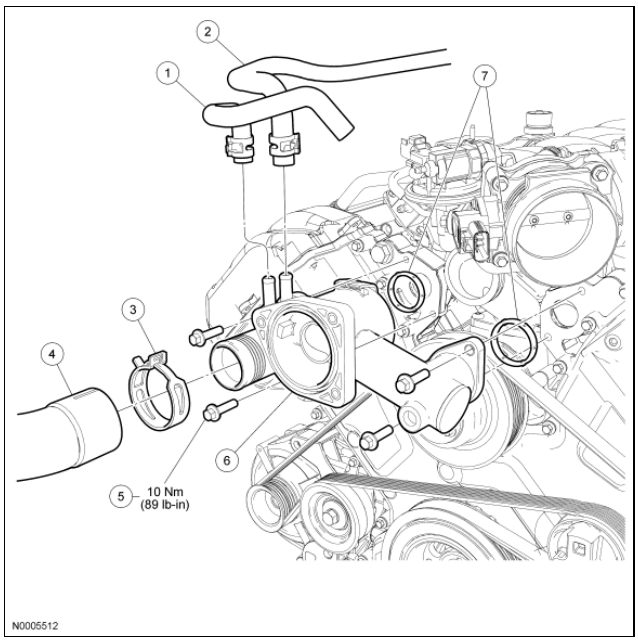
5. Remove the 3 bolts and the coolant pump pulley.
   - To install, tighten to 10 Nm (89 lb-in), then rotate an additional 45 degrees.

6. Remove the 5 bolts and the coolant pump.
   - Remove and discard the coolant pump gasket.
   - To install, tighten to 8 Nm (71 lb-in), then rotate an additional 90 degrees.

7. To install, reverse the removal procedure.
   - Install a new coolant pump gasket.

8. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Coolant Outlet Pipe



Item	Part Number	Description
1	9F813	Throttle body heater hose
2	8276	Degas bottle hose
3	15161	Upper radiator hose clamp
4	3W43	Upper radiator hose
5	W500015	Coolant outlet pipe bolts (4 required)
6	8A504	Coolant outlet pipe
7	W707299	Coolant outlet pipe seals (2 required)

Removal and Installation

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the thermostat housing. For additional information, refer to Thermostat Housing in this section.

3. Disconnect the throttle body heater hose from the coolant outlet pipe and position aside.

4. Disconnect the degas bottle hose from the coolant outlet pipe and position aside.

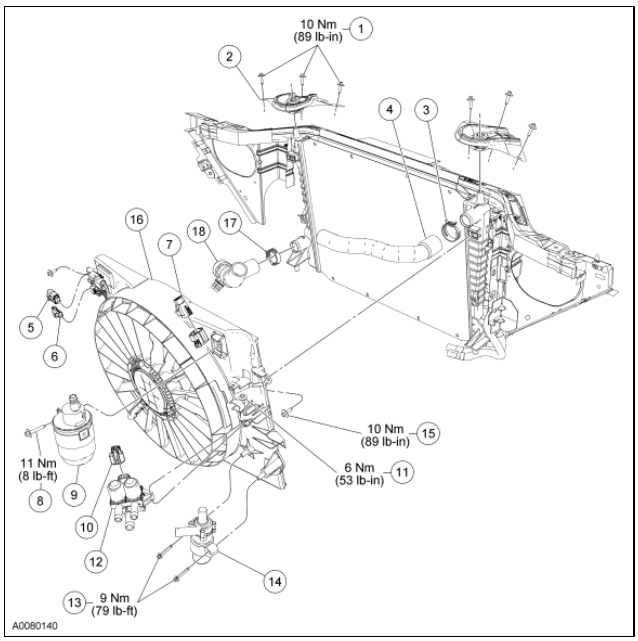
5. Disconnect the upper radiator hose from the coolant outlet pipe and position aside.

6. Remove the 4 bolts and the coolant outlet pipe.
   - Inspect the 2 coolant outlet pipe seals and install new seals if necessary.
   - To install, tighten to 10 Nm (89 lb-in).

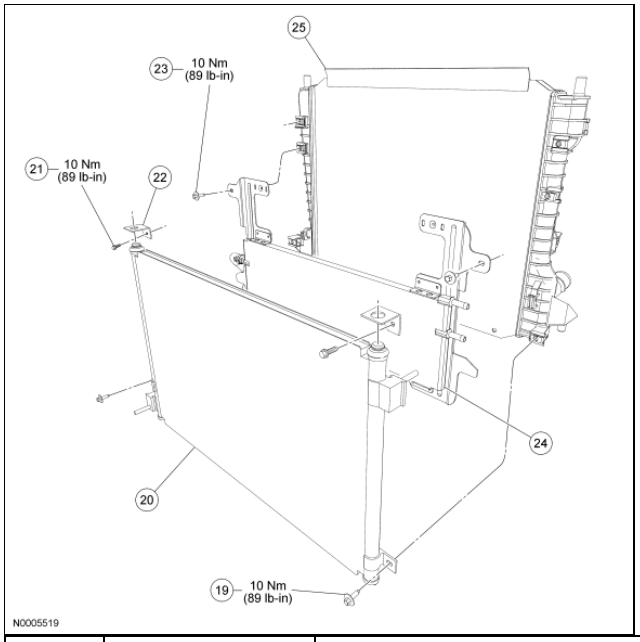
7. To install, reverse the removal procedure.

8. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Cooling System Components — Exploded View, Radiator, Cooling Fan Motor and Shroud



Item	Part Number	Description
1	N606677	Upper radiator support bracket bolts (6 required)
2	8226	Upper radiator support bracket (2 required)
3	15161	Upper radiator hose clamp
4	8260	Upper radiator hose
5	14A464	Electric cooling fan electrical connector
6	14A464-YB	Electric cooling fan electrical connector
7	14A464-AE	Coolant control valve jumper harness electrical connector
8	N606679	Receiver/drier bolt
9	19959	Receiver/drier and bracket
10	14A464-AE	Coolant control valve electrical connector
11	W707845	Coolant control valve bolt
12	18495	Coolant control valve
13	W702706	Auxiliary coolant pump bolts (2 required)
14	18D474	Auxiliary coolant pump
15	N606676	Cooling fan motor and shroud bolt (2 required)
16	8C607	Cooling fan motor and shroud
17	15161	Lower radiator hose clamp
18	8B273	Lower radiator hose



Item	Part Number	Description
19	N606676	A/C condenser bolts (2 required)
20	19710	A/C condenser
21	N606676	A/C condenser upper bracket bolt (2 required)
22	—	A/C condenser upper bracket (2 required)
23	N606676	Combination cooler bolt (2 required)
24	3F749	Combination cooler
25	8005	Radiator

1. For additional information, refer to the procedures in this section.

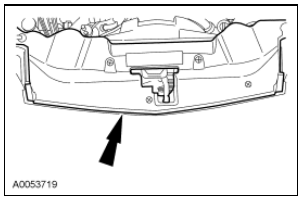
Radiator

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

3. Remove the cooling fan motor and shroud. For additional information, refer to Cooling Fan Motor and Shroud in this section.

4. Remove the upper radiator sight shield.



5. Disconnect the upper radiator hose from the radiator and position aside.

6. Disconnect the lower radiator hose from the radiator and position aside.

7. Remove the 6 bolts and the 2 upper radiator support brackets.
   - To install, tighten to 10 Nm (89 lb-in).

8. **NOTE:** Lower the A/C condenser to gain access to the A/C condenser-to-radiator bolts.

   Remove the 2 A/C condenser retaining bolts and position the A/C condenser aside.

   - To install, tighten to 10 Nm (89 lb-in).

9. Remove the 2 A/C condenser upper bracket bolts and the 2 upper brackets.
   - To install, tighten to 10 Nm (89 lb-in).

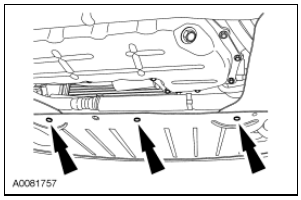
10. **NOTE:** It may be necessary to lean the radiator forward to gain access to the combination cooler bolts.

    NOTE: Lift the combination cooler up and forward to release it from the radiator retaining clips.

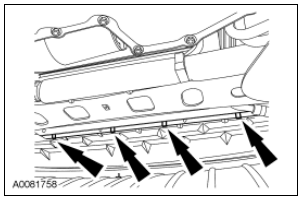
    Remove the 2 bolts and position the combination cooler aside.

    - To install, tighten to 10 Nm (89 lb-in).

11. Remove the 3 bolts and position the shield down.



12. Release the clips and position the radiator shield down and remove the radiator.



13. To install, reverse the removal procedure.
    - Make sure that the combination cooler is seated in the radiator retaining clips.

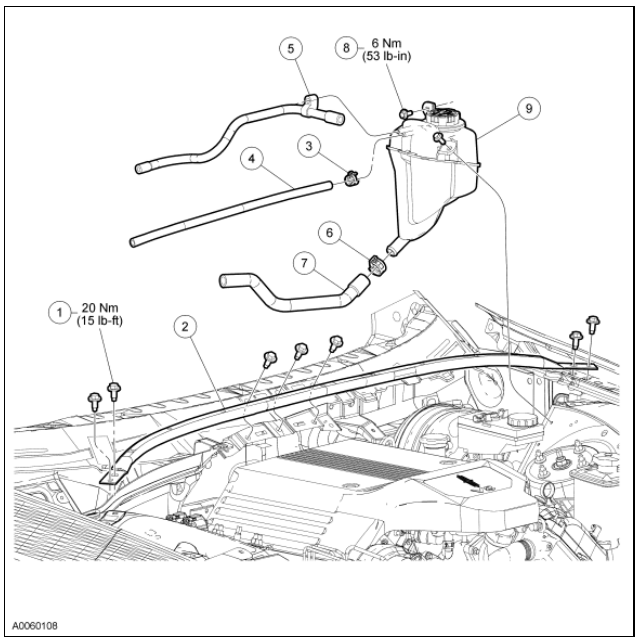
14. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Cooling Fan Motor and Shroud

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .
3. Disconnect the 2 cooling fan motor and shroud electrical connectors.
4. Disconnect the coolant control valve jumper harness electrical connector.
5. Remove the bolt and the receiver/drier and bracket and position aside.
   - To install, tighten to 11 Nm (8 lb-ft).
6. Disconnect the coolant control valve electrical connector.
7. Remove the bolt and the coolant control valve and position it aside.
   - To install, tighten to 6 Nm (53 lb-in).
8. Remove the 2 bolts and the auxiliary coolant pump.
   - To install, tighten to 9 Nm (79 lb-in).
9. Remove the 2 bolts and the cooling fan motor and shroud.
   - To install, tighten to 10 Nm (89 lb-in).
10. To install, reverse the removal procedure.

Degas Bottle



Item	Part Number	Description
1	W708009	Cross vehicle support bolt (7 required)
2	3B328	Cross vehicle support
3	15161	Engine vent hose clamp
4	8276	Engine vent hose
5	8C289	Air bleed hose
6	15161	Degas bottle return hose clamp
7	—	Degas bottle return hose
8	W705968	Degas bottle bolt (2 required)
9	8A080	Degas bottle

Removal and Installation

1. ⚠ **WARNING: To avoid personal injury, do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

   Release the pressure in the cooling system by slowly turning the pressure relief cap one half turn counterclockwise. When the pressure is released, remove the pressure relief cap.

2. Using hose clamp pliers, clamp the degas bottle return hose.

3. Using a suitable suction device, siphon the coolant from the degas bottle.

4. Remove the cowl panel grille. For additional information, refer to Section 501-02 .

5. Remove the 7 bolts and the cross vehicle support.
   - To install, tighten to 20 Nm (15 lb-ft).

6. Disconnect the engine vent hose and air bleed hose from the degas bottle and position aside.

7. Disconnect the degas bottle return hose from the degas bottle and position aside.

8. Remove the 2 bolts and the degas bottle.
    - To install, tighten to 6 Nm (53 lb-in).

9. To install, reverse the removal procedure.

10. Fill the degas bottle. Refer to Cooling System Draining, Filling and Bleeding for the recommended coolant mixture and fill level.

General Specifications

Item	Specification
Lubricants and Chemicals	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

Torque Specifications

Description	Nm	lb-in
Electronic throttle body bolts	10	89
Engine appearance cover bracket nuts	6	53
Fuel injection supply manifold bolts	9	80

Fuel Charging and Controls

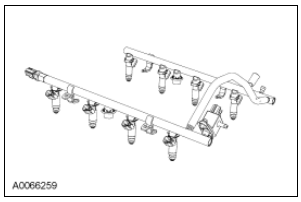
The fuel charging and controls system consists of the following:

- Electronic throttle body
- Fuel injectors
- Fuel charging wiring harness
- Fuel rail

The fuel charging and controls system is:

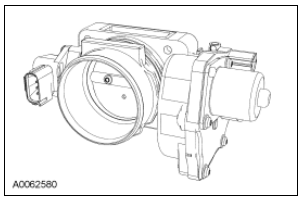
- a sequential multiport fuel injection (SFI) system.
- pulse-width modulated.
- mass airflow controlled.

The powertrain control module (PCM) controls the fuel injection system. Injector pulse-width is varied to control the amount of fuel flow. Varying fuel pump output controls fuel pressure. The PCM commands the fuel pump driver module, which directly controls the fuel pump. The throttle body is electronically controlled by the engine management system (EMS). Throttle plate angle is changed electronically in response to throttle pedal movements initiated by the driver.



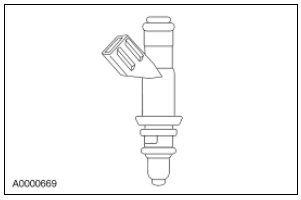
The fuel rail:

- delivers fuel to the individual fuel injectors.
- receives fuel from the fuel supply tube.



The electronic throttle body:

- controls air supply to the intake manifold by electronically positioning the throttle plate.
- is not adjustable.
- must not be cleaned.



The fuel injectors:

- are electronically operated by the powertrain control module (PCM).
- atomize the fuel as the fuel is delivered.
- each have an internal solenoid which opens a needle valve to inject fuel into the lower intake manifold.
- are deposit-resistant.

The fuel pressure sensor:

- maintains constant fuel pressure to the fuel injectors and throughout the fuel system.
- is spring-loaded and operated by intake manifold vacuum.

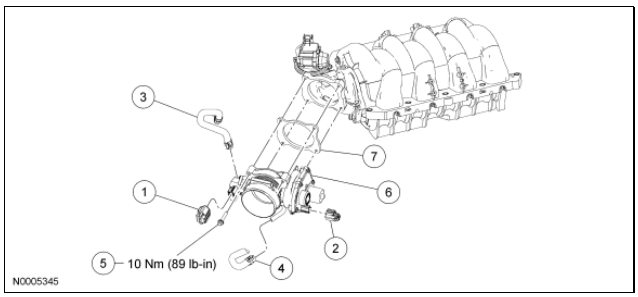
The engine wiring harness:

- connects the fuel injectors and other electronic engine controls, such as the throttle position (TP) sensor, to the PCM.
- receives fuel injector signals from the PCM and transfers the signals to the fuel injectors.

Fuel Charging and Controls

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Throttle Body



Item	Part Number	Description
1	—	Throttle position (TP) sensor electrical connector (part of 14A464)
2	—	Electronic throttle body motor electrical connector (part of 14A464)
3	9F813	Throttle body heater inlet hose and clamp assembly
4	9F914	Throttle body heater outlet hose and clamp assembly
5	W503280	Throttle body bolt (4 required)
6	9F991	Electronic throttle body
7	9F809	Electronic throttle body gasket

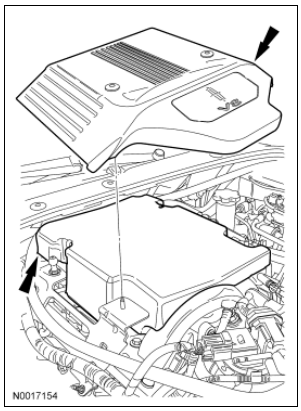
Removal and Installation

⚠ CAUTION: Throttle body bore and plate area have a special coating and cannot be cleaned, or possible damage to the throttle body can occur.

NOTE: Only a small amount of coolant may be lost when disconnecting the throttle body heater inlet and outlet hose.

1. **⚠ CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Remove the engine appearance cover and the noise suppressor (if detached).



2. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

3. Disconnect the throttle position (TP) sensor electrical connector from the TP sensor.

4. Disconnect the electronic throttle body motor electrical connector from the electronic throttle body.

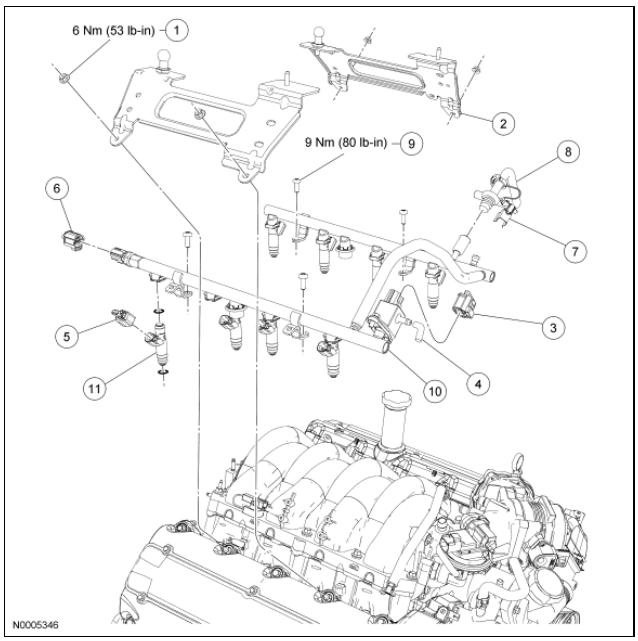
5. Disconnect the throttle body heater inlet hose and clamp assembly from the electronic throttle body and position it aside.

6. Disconnect the throttle body heater outlet hose and clamp assembly from the electronic throttle body and position it aside.

7. Remove the 4 bolts and the electronic throttle body.
    - Remove and discard the intake manifold-to-electronic throttle body gasket.
    - To install, tighten to 10 Nm (89 lb-in).

8. To install, reverse the removal procedure.
    - Install a new intake manifold-to-electronic throttle body gasket.

Fuel Rail and Fuel Injector — Exploded View



Item	Part Number	Description
1	W520411	Engine appearance cover mounting bracket nut (4 required)
2	129723	Engine appearance cover mounting bracket (2 required)
3	—	Fuel pressure sensor electrical connector (part of 12B637)
4	—	Fuel pressure sensor vacuum connector (part of 9E498)
5	—	Fuel injector electrical connector (part of 12B637) (8 required)
6	—	Fuel temperature sensor electrical connector (part of 12B637)
7	—	Fuel supply tube retaining clip
8	—	Fuel supply tube spring lock coupling
9	—	Fuel rail bolt (4 required)
10	—	Fuel rail
11	—	Fuel injector (8 required)

1. For additional information, refer to the procedures in this section.

Fuel Rail

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited, resulting in possible personal injury.

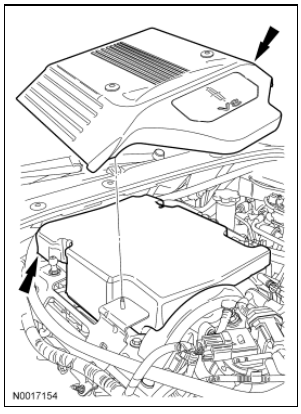
⚠ WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before working on or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved. Failure to do so can result in personal injury.

1. Release the fuel system pressure. For additional information, refer to Section 310-00 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. **⚠ CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Remove the engine appearance cover and the noise suppressor (if detached).



4. Remove the 4 engine appearance cover mounting bracket nuts and the brackets.
   - To install, tighten to 6 Nm (53 lb-in).

5. Disconnect the fuel pressure sensor electrical connector from the fuel pressure sensor.

6. Disconnect the fuel pressure sensor vacuum connector from the fuel pressure sensor.

7. Disconnect the 8 fuel injector electrical connectors from the fuel injectors.

8. Disconnect the fuel temperature sensor electrical connector from the fuel temperature sensor.

9. Disconnect the fuel supply tube spring lock coupling. For additional information, refer to Section 310-00 .

10. Remove the 4 bolts and the fuel rail and fuel injectors as an assembly.
    - To install, tighten to 9 Nm (80 lb-in).

11. Remove the 8 fuel injectors from the fuel rail.

12. ⚠ **CAUTION: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-ring seals can cause the fuel system to leak. Do not reuse the O-ring seals.**

    Remove and discard the 16 O-ring seals from the fuel injectors.

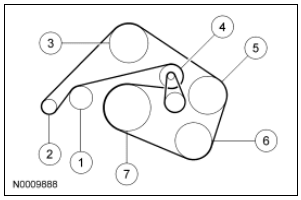
13. To install, reverse the removal procedure.
    - Lubricate the new fuel injector O-ring seals with clean engine oil before installing.
    - Align the fuel tube fittings and press together until an audible click is heard. Then, pull on the fittings to make sure they are fully engaged.

Torque Specifications

Description	Nm	lb-ft
Accessory drive belt tensioner bolt	40	30
Accessory drive belt idler pulley bolt	40	30

Accessory Drive

Component Locations



Item	Part Number	Description
1	19A216	Belt idler pulley — unflanged
2	10A352	Generator pulley
3	8509	Coolant pump pulley
4	6B209	Accessory drive belt tensioner
5	3D673	Power steering pump pulley
6	19D748	A/C clutch pulley
7	6316	Crankshaft vibration damper

The accessory drive:

- has a single serpentine belt (6 ribs).
- has an automatic tensioner.
- is not adjustable.

Accessory Drive

Inspection and Verification

NOTICE: **Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.**

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical damage.

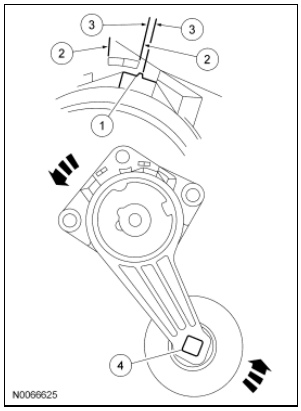
Visual Inspection Chart

Mechanical
• Drive belt cracking/chunking/wear • Belt/pulley contamination • Incorrect accessory drive belt • Incorrectly routed accessory drive belt • Pulley misalignment or excessive pulley runout • Loose or mislocated hardware • Incorrectly routed power steering tubes (rubbing) • Loose accessory drive belt • Damaged pulleys • Tensioner arm misalignment

Belt Tensioner With Belt Length Indicator

NOTE: Modular engine (without A/C) belt tensioner shown, others similar.

NOTE: Belt tensioner is shown in the free-state position against the arm travel stops.



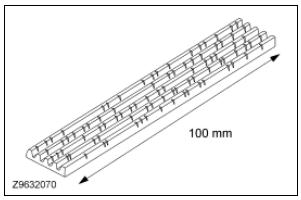
Item	Part Number	Description
1	—	Belt length indicator
2	—	Acceptable belt installation and wear range
3	—	Belt replacement range
4	—	Belt tension relief point

3. Check that the belt length indicator, if equipped, on the belt tensioner is in the acceptable belt installation and wear range. If the indicator is in the belt replacement range, either an incorrect belt is installed or the belt is worn beyond the service limit. Install a new belt as necessary.

4. Eliminate all other non-belt related noises that could cause belt misdiagnosis, such as A/C compressor engagement chirp, A/C slugging noise, power steering cavitations at low temperatures, Variable Camshaft Timing (VCT) tick or generator whine.

5. If a concern is found, correct the condition before proceeding to the next step.

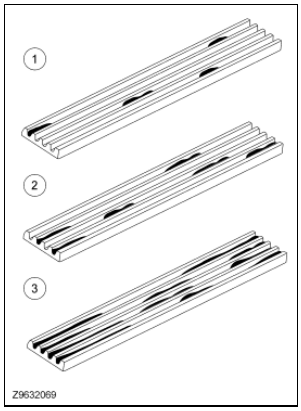
V-Ribbed Serpentine Drive Belt With Cracks Across Ribs



6. Check the belt for cracks. Up to 15 cracks in a rib over a distance of 100 mm (4.0 in) can be considered acceptable. If cracks exceed this standard, install a new belt.

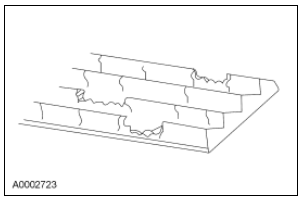
V-Ribbed Serpentine Belt With Piling

NOTE: Piling is an excessive buildup in the V-grooves of the belt.



7. The condition of the V-ribbed drive belt should be compared against the illustration and appropriate action taken.
    1. Small scattered deposits of rubber material. This is not a concern, therefore, installation of a new belt is not required.
    2. Longer deposit areas building up to 50% of the rib height. This is not considered a durability concern, but it can result in excessive noise. If noise is apparent, install a new belt.
    3. Heavy deposits building up along the grooves resulting in a possible noise and belt stability concern. If heavy deposits are apparent, install a new belt.

V-Ribbed Serpentine Belt With Chunks of Rib Missing



8. There should be no chunks missing from the belt ribs. If the belt shows any evidence of this, install a new accessory drive belt.

9. If the concern is not visually evident, verify the symptom and GO to Symptom Chart .

Symptom Chart

Symptom Chart

Component Tests

Drive Belt — Noise/Flutter

NOTICE: **Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.**

Drive belt chirp occurs due to pulley misalignment or excessive pulley runout. It can be the result of a damaged or incorrectly aligned grooved pulley.

To correct, determine the area where the noise comes from. Check each of the pulleys in that area with a straightedge to the crankshaft pulley. Look for accessory pulleys out of position in the fore/aft direction or at an angle to the straightedge.

Drive belt squeal may be an intermittent or constant noise that occurs when the drive belt slips on an accessory pulley under certain conditions.

A short intermittent squeal may occur during engine start up and shut down or during very rapid engine acceleration and decelerations, such as:

- Wide Open Throttle (WOT) 1-2 and 2-3 shifts or 2-3 and 3-4 back-out shifts on automatic transmissions.
- WOT 1-2 and 2-3 shifts and any combination of rapid downshifting on manual transmissions.

These special short-term transient events are expected, and are due to the higher system inertias required to meet the electrical and cooling demands on today's vehicle systems. Constant or reoccurring drive belt squeal can occur:

- if the A/C discharge pressure goes above specifications:
  - ♦ the A/C system is overcharged.
  - ♦ the A/C condenser core airflow is blocked.
  - ♦ the A/C anti-slugging strategy executes after a long hot heat soak.
- if the A/C off equalized pressure (the common discharged and suction pressure that occurs after several minutes) exceeds specifications.
- if any of the accessories or idler pulley(s) are damaged or have a worn or damaged bearing. All accessories should be rotatable by hand in the unloaded condition. If not, inspect the accessory.
- if there is evidence of fluid contamination on the accessory drive belt. When the drive belt has been exposed to fluid contamination during vehicle operation, such as leaks from the power steering system, A/C system or cooling system, clean all pulleys with soap and water, rinse with clean water and install a new accessory drive belt. If the drive belt has been exposed to fluids in a localized area during routine vehicle service, such as replacement of hoses or fluids, the drive belt and pulleys should be washed with soap and water immediately (prior to starting the engine), and rinsed with clean water.
- if the accessory drive belt is too long. A drive belt that is too long will allow the accessory drive belt tensioner arm to go all the way to the arm travel stop under certain load conditions, which will release tension to the drive belt. If the accessory drive belt tensioner indicator is outside the normal installation wear range window, install a new accessory drive belt.
- **NOTE:** The accessory drive belt tensioner arm should rotate freely without binding.

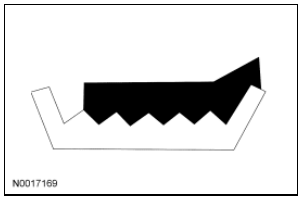
  Install a new accessory drive belt tensioner if the drive belt tensioner is worn or damaged.

Drive Belt — Incorrect Installation

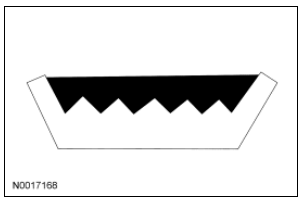
NOTICE: **Incorrect accessory drive belt installation will cause excessive drive belt wear and may cause the drive belt to come off the pulleys.**

Non-standard accessory drive belts can track differently or incorrectly. If an accessory drive belt tracks incorrectly, install a new accessory drive belt to avoid performance failure or loss of the drive belt.

Incorrect Installation



Correct Installation



With the engine running, check accessory drive belt tracking on all pulleys. If the edge of the accessory drive belt rides beyond the edge of the pulleys, noise and premature wear will occur. Make sure the accessory drive belt rides correctly on the pulley. If an accessory drive belt tracking condition exists, proceed with the following:

- Visually check the accessory drive belt tensioner for damage and wear, especially the mounting pad surface and arm alignment. If the accessory drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. If the tensioner arm is worn, the arm will be out of alignment. Either of these conditions will result in chirp and squeal noises.
- With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or the pulley forward faces) for excessive wobble. Install new components as necessary.
- Check all accessories, mounting brackets and the accessory drive belt tensioner for any interference that would prevent the component from mounting correctly. Correct any interference condition and recheck the accessory drive belt tracking.
- Tighten all accessories, mounting brackets and accessory drive belt tensioner retaining hardware to specification. Recheck the accessory drive belt tracking.

Belt Tensioner — Mechanical

The only mechanical check that needs to be made is a check for tensioner stick, grab or bind.

1. With the engine off, check routing of the accessory drive belt. Refer to the illustrations under Accessory Drive in the Description and Operation portion of this section.

2. **NOTE:** The accessory drive belt tensioner spring is very strong and requires substantial force to release.

   Using a suitable, commercially available serpentine belt tensioner release tool, release the tension on the belt and detach the accessory drive belt from the tensioner. Carry out the following tests:

   - Using the release tool, move the tensioner from its relaxed position, through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.
   - Rotate the tensioner pulley by hand and check for a binding, contaminated or seized condition.
   - Inspect the area surrounding the accessory drive belt tensioner for oil leaks or contamination and repair any leaks.

3. If the accessory drive belt tensioner does not meet the criteria in the previous step, install a new tensioner. If the accessory drive belt tensioner meets the criteria in the previous step, proceed to testing the tensioner dynamically.

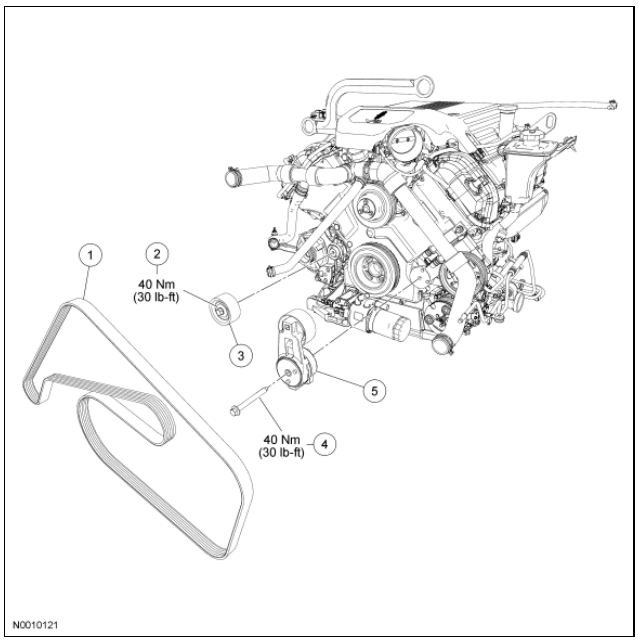
4. If the tensioner is saturated with oil and grease internally, install a new tensioner.

Belt Tensioner — Dynamics

The accessory drive belt tensioner can be checked dynamically as follows:

1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive tensioner should move (respond) when the A/C clutch cycles (if equipped), or when the engine is accelerated rapidly. If the accessory drive belt tensioner movement is excessive without A/C clutch cycling or engine acceleration, check belt rideout. Excessive belt rideout (uneven depth of grooves in the belt) can cause excessive accessory drive belt tensioner movement. Check rideout condition by installing a new belt. If excessive accessory drive belt tensioner movement still exists, install a new accessory drive belt tensioner.

Front End Accessory Drive (FEAD) — Exploded View



Item	Part Number	Description
1	8620	Accessory drive belt
2	N808102	Accessory drive belt idler pulley mounting bolt (part of 8620)
3	8678	Accessory drive belt idler pulley
4	—	Accessory drive belt tensioner mounting bolt
5	6B209	Accessory drive belt tensioner

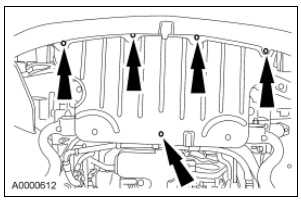
1. For additional information, refer to the procedures in this section.

Accessory Drive Belt

Removal and Installation

1. With the vehicle in NEUTRAL, position on a hoist. For additional information, refer to Section 100-02 .

2. Remove the front lower splash shield.



3. Rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.

4. ⚠ **CAUTION: Incorrect drive belt installation will cause premature drive belt failure.**

   NOTE: Make sure the drive belt is correctly installed on each pulley.

   To install, reverse the removal procedure.

Accessory Drive Belt Tensioner

Removal and Installation

1. Remove the accessory drive belt. For additional information, refer to Accessory Drive Belt in this section.

2. Remove the bolt and the accessory drive belt tensioner.
   - To install, tighten to 40 Nm (30 lb-ft).

3. To install, reverse the removal procedure.

Accessory Drive Belt Idler Pulley

1. Remove the accessory drive belt. For additional information, refer to Accessory Drive Belt in this section.

2. Remove the bolt and the accessory drive belt idler pulley.
   - To install, tighten to 40 Nm (30 lb-ft).

3. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Starter solenoid wire nut	6	—	53
Starter solenoid battery cable nut	12	9	—
Battery ground cable nut	25	18	—
Starter motor bolts	25	18	—

Starting System

The starting system consists of the following components:

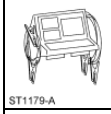
- Starter motor
- Ignition switch
- Digital transmission range (TR) sensor
- Starter relay
- Battery

The function of the starting system is to crank the engine at a speed fast enough to permit the engine to start.

Starting System

Refer to Wiring Diagrams Cell 20 , Starting System for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST1179-A	Alternator, Regulator, Battery and Starter Tester (ARBST) 010-00725 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Principles of Operation

The starting system is electronically controlled by the passive anti-theft system (PATS). The PATS recognizes the correct electronically coded ignition key and signals the instrument cluster to provide a ground for the starter relay. The energized relay provides voltage to the starter solenoid with the key in the START position, thereby allowing the starter motor to activate.

Inspection and Verification

⚠ WARNING: When carrying out underhood work in the vicinity of the starter motor, be aware that the heavy gauge battery input lead at the starter solenoid is "electrically hot" at all times. A protective cap or boot is provided over the terminal of this lead and must be installed after the repair procedure is completed. Failure to follow these instructions may result in personal injury.

⚠ WARNING: When working in the area of the starter motor, be careful to avoid touching hot exhaust components. Failure to follow these instructions can result in personal injury.

NOTE: When working on the starter system, make sure the anti-theft system is deactivated.

1. Verify the customer concern by operating the system.
2. Remove the accessory drive belt. Refer to Section 303-05 . Verify the crankshaft and each of the components driven by the accessory drive belt rotate and are not seized or damaged.
3. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Starter motor • Brackets	• Battery • Auxiliary junction box (AJB) fuse: ♦ 121 (30A) • Battery junction box (BJB) fuse: ♦ 22 (20A) • Central junction box (CJB) fuse: ♦ 201 (5A) • Starter relay • Loose or corroded connectors • Anti-theft system • Damaged wiring

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

5. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

6. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

7. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - [appropriate communication networks, such as SCP, ISO, UBP, CAN] circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for generic electronic module (GEM), refer to Section 419-10 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the GEM.

8. If the DTCs retrieved are related to the concern, go to the Generic Electronic Module (GEM) Diagnostic Trouble Code (DTC) Index.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Passive Anti-Theft System (PATS) — Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1213	Anti-Theft Number Of Programmed Keys Is Below Minimum	Instrument Cluster	REFER to Section 419-01B .

B1342	ECU is Defective	Instrument Cluster	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test.
B1600	Passive Anti-Theft System (PATS) Key Transponder Is Not Received — Damaged Key Or Non-PATS Key	Instrument Cluster	REFER to Section 419-01B .
B1601	PATS Received Incorrect Key-Code From Key Transponder (Unprogrammed PATS Key)	Instrument Cluster	REFER to Section 419-01B .
B1602	PATS Received Invalid Format Of Key-Code From Key Transponder (Partial Key Read)	Instrument Cluster	REFER to Section 419-01B .
B1681	PATS Transceiver Module Signal Is Not Received (Damaged, Not Connected Or Damaged Wiring)	Instrument Cluster	REFER to Section 419-01B .
B2103	Antenna Not Connected — Defective Transceiver	Instrument Cluster	REFER to Section 419-01B .
B2139	Data Mismatch	Instrument Cluster	REFER to Section 419-01B .
B2141	NVM Memory Failure	Instrument Cluster	REFER to Section 419-01B .
B2431	Transponder Programming Failed	Instrument Cluster	REFER to Section 419-01B .
B2477	Module Configuration Failure	Instrument Cluster	REFER to Section 418-01 .
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security	Instrument Cluster/Powertrain Control Module (PCM)	REFER to Section 419-01B .
U1262	SCP Communications BUS Fault	Instrument Cluster/PCM	REFER to Section 418-00 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Engine Does Not Crank

Normal Operation

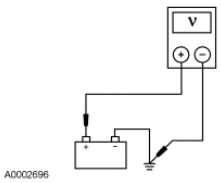
Under normal operation, the auxiliary junction box (AJB) supplies constant power to the starter relay on circuit 30-BB13 (RD/OG) through fuse 121 (30A). When the key is placed in the START position, with the vehicle in PARK or NEUTRAL, the TR sensor provides power on circuit 50S-BB12 (GY) and the instrument cluster provides ground on circuit 31S-BB12 (BK/YE). The coil of the relay is energized and sends power to

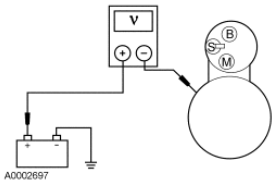
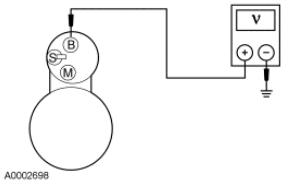
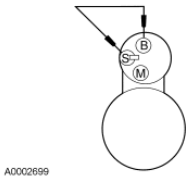
the starter motor on circuit 50-BB10 (GY/BK).

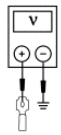
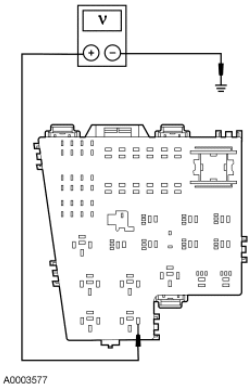
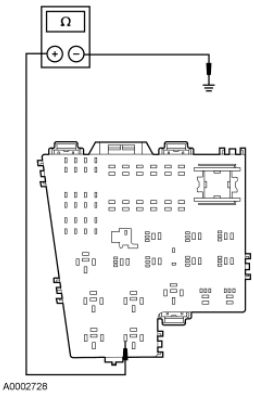
Possible Causes

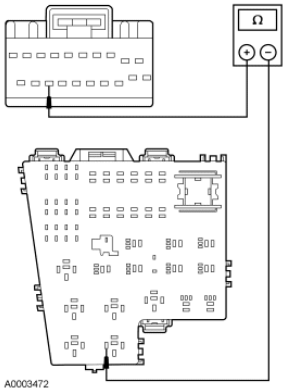
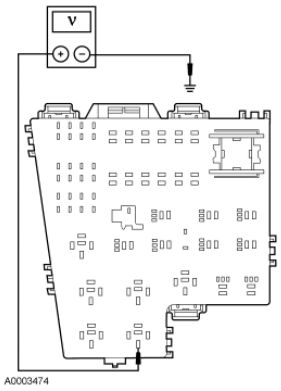
- Battery
- Ignition switch
- Starter relay
- Anti-theft system
- Circuitry
- Auxiliary junction box (AJB) fuse:
  - ♦ 121 (30A)
- Battery junction box (BJB) fuse:
  - ♦ 22 (20A)
- Central junction box (CJB) fuse:
  - ♦ 201 (5A)

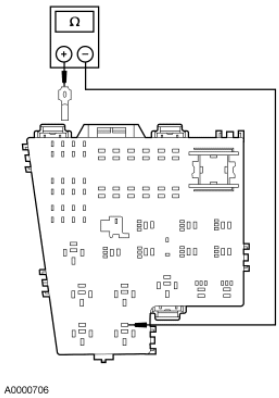
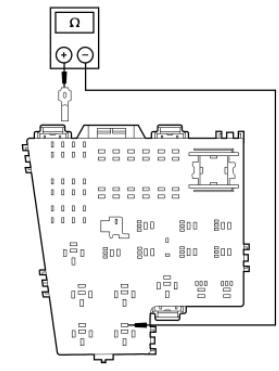
PINPOINT TEST A: THE ENGINE DOES NOT CRANK

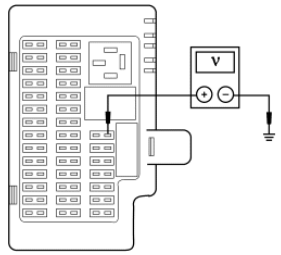
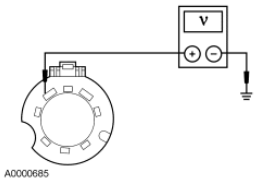
Test Step	Result / Action to Take
A1 CHECK FOR INSTRUMENT CLUSTER DIAGNOSTIC TEST CODES	
• **NOTE:** The instrument cluster PATS DTCs are the only DTCs of concern in this step. Only repair retrieved non-PATS DTCs if a customer concern is reported. • Carry out the instrument cluster self-test. Refer to Section 413-00 . • **Were any PATS DTCs retrieved from the instrument cluster?**	**Yes** GO to Section 419-01B to diagnose the PATS DTCs. **No** GO to A2 .
A2 CHECK THE BATTERY	
• Check the battery condition and charge if necessary. Refer to Section 414-01 . • **Is the battery OK?**	**Yes** GO to A3 . **No** CHARGE or INSTALL a new battery as necessary. REFER to Section 414-01 . TEST the system for normal operation.
A3 CHECK THE BATTERY GROUND CABLE	
• Measure the voltage between the positive battery post and the battery ground cable connection on the engine.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A4 . **No** INSTALL a new battery ground cable. REFER to Section 414-01 . TEST the system for normal operation.

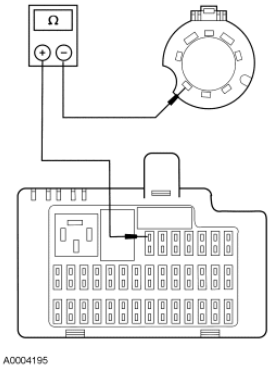
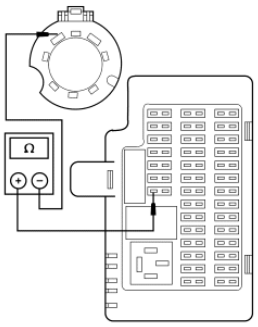
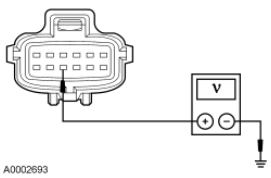
A4 CHECK THE STARTER MOTOR GROUND	
• Measure the voltage between the battery positive post and the starter motor case.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A5 . **No** CLEAN the starter motor mounting flange and make sure the starter motor is correctly mounted. TEST the system for normal operation.
A5 CHECK THE POWER SUPPLY TO THE STARTER MOTOR	
• Measure the voltage between the starter motor B-terminal and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A6 . **No** REPAIR circuit 30-BB10 (RD). TEST the system for normal operation.
A6 CHECK THE STARTER MOTOR B-TERMINAL	
• Connect a fused jumper wire to the B-terminal of the starter motor. Momentarily connect the other lead of the jumper wire to the starter motor S-terminal.  • **Did the starter motor engage and the engine crank?**	**Yes** GO to A7 . **No** INSTALL a new starter motor. REFER to Starter Motor in this section. TEST the system for normal operation.
A7 CHECK THE START INPUT TO THE STARTER MOTOR	
• Disconnect: Starter Motor C197. • Measure the voltage between starter motor C197a, circuit 50-BB10 (GY/BK), harness side and ground with the ignition switch in the START position.	**Yes** CLEAN the starter motor S-terminal and connector. CHECK the wiring and the starter motor for a loose or intermittent connection. TEST the system for normal operation. **No**

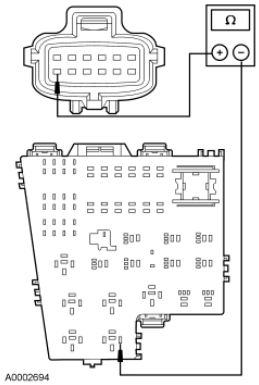
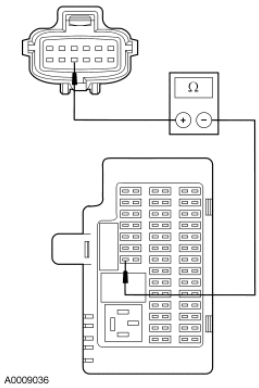
 A0002700 • **Is the voltage greater than 10 volts in START?**	GO to A8 .
A8 CHECK THE START INPUT TO THE STARTER RELAY	
• Disconnect: Starter Relay. • Make sure the vehicle is in PARK or NEUTRAL. • Turn the ignition switch to START and hold. • Measure the voltage between starter relay C1017-86, circuit 50S-BB12 (GY), harness side and ground.  A0003577 • **Is the voltage greater than 10 volts?**	**Yes** GO to A9 . **No** GO to A14 .
A9 CHECK THE GROUND SUPPLY TO THE STARTER RELAY	
• Make sure the vehicle is in PARK or NEUTRAL. • Turn the ignition switch to START and hold. • Measure the resistance between starter relay C1017-85, circuit 31S-BB12 (BK/YE), harness side and ground.  A0002728 • **Is the resistance less than 5 ohms?**	**Yes** GO to A11 . **No** GO to A10 .

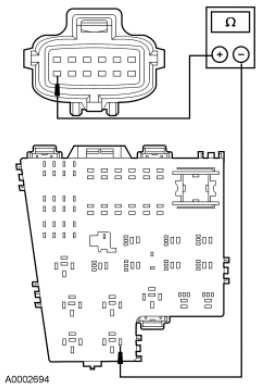
A10 CHECK CIRCUIT 31S-BB12 (BK/YE) FOR AN OPEN	
• Disconnect: Instrument Cluster C220b. • Measure the resistance between starter relay C1017-85, circuit 31S-BB12 (BK/YE), harness side and instrument cluster C220b-18, circuit 31S-BB12 (BK/YE), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . **No** REPAIR the circuit. TEST the system for normal operation.
A11 CHECK THE BATTERY SUPPLY TO THE STARTER RELAY	
• Measure the voltage between starter relay C1017-30, circuit 30-BB13 (RD/OG), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A12 . **No** REPAIR the circuit. TEST the system for normal operation.
A12 CHECK CIRCUITS 50-BB10 (GY/BK) AND 50S-BB12 (GY) FOR AN OPEN	

• Disconnect the eyelet from the starter S-terminal. • Measure the resistance between starter relay C1017-87, circuit 50-BB10 (GY/BK), harness side and S-terminal eyelet C197a, circuit 50-BB10 (GY/BK), harness side.  A0000706 • **Is the resistance less than 5 ohms?**	**Yes** GO to A13 . **No** REPAIR the circuit(s). TEST the system for normal operation.
A13 CHECK CIRCUITS 50-BB10 (GY/BK) AND 50S-BB12 (GY) FOR A SHORT TO GROUND	
• Measure the resistance between starter relay C1017-87, circuit 50-BB10 (GY/BK), harness side and S-terminal eyelet C197a, circuit 50-BB10 (GY/BK), harness side.  A0000706 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new starter relay. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A14 CHECK FUSE 201 (5A)	
• Check fuse: CJB Fuse 201 (5A). • **Is CJB fuse 201 (5A) open?**	**Yes** GO to A21 . **No** GO to A15 .
A15 CHECK THE START INPUT TO FUSE 201 (5A)	

• Disconnect: CJB Fuse 201 (5A). • Turn the ignition switch to the START position and hold. • Measure the voltage between CJB fuse 201 (5A) input terminal and ground.  A0000670 • **Is the voltage greater than 10 volts?**	**Yes** GO to A19 . **No** GO to A16 .
A16 CHECK THE BATTERY INPUT TO THE IGNITION SWITCH	
• Disconnect: Ignition Switch C250. • Measure the voltage between ignition switch C250-1, circuit 30-BB9 (RD), harness side and ground.  A0000685 • **Is the voltage greater than 10 volts?**	**Yes** GO to A17 . **No** REPAIR the circuit. TEST the system for normal operation.
A17 CHECK CIRCUIT 50-DD5 (GY/BK) FOR AN OPEN	
• Measure the resistance between ignition switch C250-3, circuit 50-DD5 (GY/BK), harness side and CJB fuse 201 (5A) input terminal, circuit 50-DD5 (GY/BK), harness side.	**Yes** GO to A18 . **No** REPAIR the circuit. TEST the system for normal operation.

 A0004195 • **Is the resistance less than 5 ohms?**	
A18 CHECK CIRCUIT 50-DD5 (GY/BK) FOR A SHORT TO GROUND	
• Measure the resistance between ignition switch C250-3, circuit 50-DD5 (GY/BK), harness side and CJB fuse 201 (5A) input terminal, circuit 50-DD5 (GY/BK), harness side.  A0002692 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new ignition switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A19 CHECK CIRCUIT 50-BB15 (GY/OG) FOR AN OPEN	
• Connect: CJB Fuse 201 (5A). • Disconnect: Digital TR Sensor C167. • Turn the ignition switch to the START position and hold. • Measure the voltage between digital TR sensor C167-10, circuit 50-BB15 (GY/OG), harness side and ground.  A0002693 • **Is the voltage greater than 10 volts?**	**Yes** GO to A20 . **No** REPAIR the circuit. TEST the system for normal operation.
A20 CHECK CIRCUIT 50S-BB12 (GY) FOR AN OPEN	

• Measure the resistance between digital TR sensor C167-12, circuit 50S-BB12 (GY), harness side and starter relay C1017-86, circuit 50S-BB12 (GY), harness side.  A0002694 • **Is the resistance less than 5 ohms?**	**Yes** ADJUST the digital TR sensor. REFER to Section 307-01 . **No** REPAIR the circuit. TEST the system for normal operation.
A21 CHECK CIRCUIT 50-BB15 (GY/OG) FOR A SHORT TO GROUND	
• Measure the resistance between digital TR sensor C167-10, circuit 50-BB15 (GY/OG), harness side and CJB fuse 201 (5A) output terminal C270b-3, circuit 50-BB15 (GY/OG), harness side.  A0009036 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A22 . **No** REPAIR the circuit. TEST the system for normal operation.
A22 CHECK CIRCUIT 50S-BB12 (GY) FOR A SHORT TO GROUND	
• Measure the resistance between digital TR sensor C167-12, circuit 50S-BB12 (GY), harness side and starter relay C1017-86, circuit 50S-BB12 (GY), harness side.	**Yes** GO to A23 . **No** REPAIR the circuit. TEST the system for normal operation.

 • **Is the resistance greater than 10,000 ohms?**	
A23 INSTALL A NEW FUSE 201 (5A)	
• Connect: Digital TR Sensor Switch C167. • Install a new CJB fuse 201 (5A). Retest the system. • **Does the fuse open?**	**Yes** ADJUST the digital TR sensor. REFER to Section 307-01 . **No** TEST the system for normal operation. VERIFY the symptom.

Pinpoint Test B: Unusual Starter Noise

Possible Causes

Unusual starter noise can be caused by:

- loose starter motor mounting bolts or brackets.
- worn or damaged flywheel ring gear.
- worn or damaged starter motor drive gear.

PINPOINT TEST B: UNUSUAL STARTER NOISE

Test Step	Result / Action to Take
B1 CHECK THE STARTER MOUNTING	
• Inspect the starter motor mounting bolts and brackets for looseness. • **Is the starter motor mounted correctly?**	**Yes** GO to B2 . **No** INSTALL the starter motor correctly. REFER to Starter Motor in this section. TEST the system for normal operation.
B2 CHECK FOR ENGINE NOISE	
• Turn the ignition switch to the OFF position. • Connect a fused jumper wire from the B-terminal to the S-terminal of the starter motor. Engage the starter motor and verify the noise is due to the starter	**Yes** GO to B3 . **No** REFER to Section 303-01 to continue the diagnosis.

operation. • **Is the noise due to the starter motor engagement?**	
B3 CHECK FOR UNUSUAL WEAR	
• Remove the starter motor. Refer to Starter Motor in this section. • Inspect the ring gear for damaged or worn teeth. • **Is the noise due to flywheel ring gear tooth damage?**	**Yes** INSTALL a new flywheel ring gear. EXAMINE the starter pinion teeth. If damaged, INSTALL a new starter motor. REFER to Starter Motor in this section. TEST the system for normal operation. **No** INSTALL a new starter motor. REFER to Starter Motor in this section. TEST the system for normal operation.

Component Tests

⚠ **WARNING: When repairing the starter motor or carrying out other underhood work in the vicinity of the starter motor, be aware that the heavy gauge battery input lead at the starter solenoid is "electrically hot" at all times. Failure to follow these instructions can result in personal injury.**

NOTICE: **A protective cap or boot is provided over the battery input terminal on all vehicle lines and must be installed after repairing. Be sure to disconnect the battery ground cable before repairing the starter motor.**

Connect the 73III Automotive Meter at the component terminal rather than at the wiring end connector. Making a connection at the wiring end connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and the component.

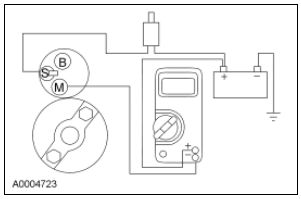
Starter Motor—Motor Feed Circuit

1. Make sure the battery is fully charged. Carry out a battery load test. For additional information, refer to Section 414-01 .

2. Disconnect the inertia fuel shutoff (IFS) switch.

3. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.

4. Connect the 73III Automotive Meter positive lead to the battery positive (+) post. Connect negative lead to the M-terminal.



5. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.8 volt or less.

6. If the voltage reading is 0.8 volt or less, go to the Starter Motor — Ground Circuit Component Test.

7. If the voltage reading is greater than 0.8 volt, this is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Move the 73III Automotive Meter negative lead to the starter solenoid B-terminal and repeat the test. If the voltage reading at the B-terminal is lower than 0.8 volt, the concern is either in the connections at the starter solenoid or in the solenoid contacts.

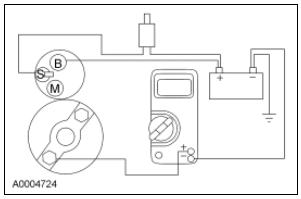
8. Remove the cables from solenoid B-, S- and M-terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6. If the voltage drop reading is still greater than 0.8 volt when checked at the M-terminal and less than 0.8 volt when checked at the B-terminal, the concern is in the solenoid contacts. Install a new starter motor.

9. If the voltage reading taken at the solenoid B-terminal is still greater than 0.8 volt after cleaning the cables and the connections at the solenoid, the concern is either in the positive (+) battery cable connection or in the positive battery cable itself. Clean the positive (+) battery cable connection. If this does not solve the problem, install a new positive battery cable. For additional information, refer to Section 414-01 .

Starter Motor—Ground Circuit

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

1. Connect the 73III Automotive Meter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative (-) battery terminal.

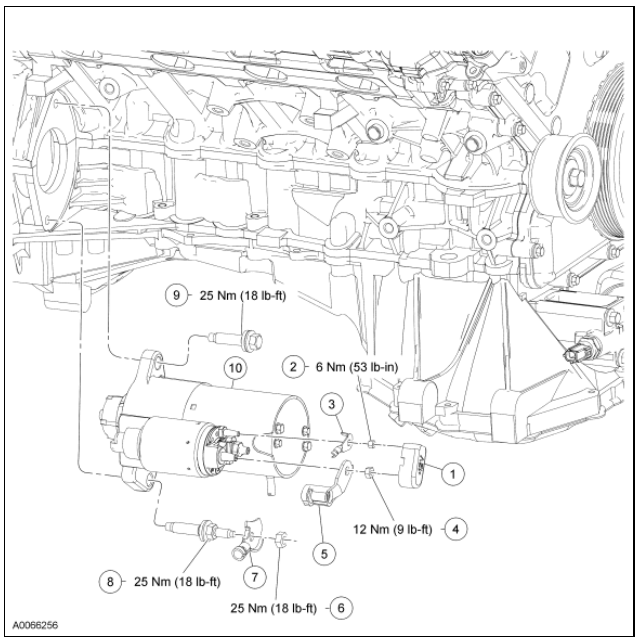


2. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.5 volt or less.

3. If the voltage is more than 0.5 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connections. Retest.

4. If the voltage is more than 0.5 volt, install a new cable. If the voltage reading is less than 0.5 volt and the engine still cranks slowly, install a new starter motor.

Starter Motor



Item	Part Number	Description
1	11N087	Starter motor solenoid terminal cover
2	N800156	Starter solenoid wire nut
3	12B637	Starter solenoid wire
4	N800136	Starter solenoid battery cable nut
5	14463	Starter solenoid battery cable
6	N500617	Ground cable nut
7	—	Ground cable (part of 14463)
8	W705359	Starter motor stud bolt
9	W704666	Starter motor bolt
10	1100	Starter motor

Removal and Installation

⚠ WARNING: When carrying out maintenance on the starting system, be aware that the heavy gauge leads are connected directly to the battery. Make sure the protective caps are in place when maintenance is completed.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Remove the starter solenoid terminal cover.

4. Remove the starter solenoid wire nut and position aside the starter solenoid wire.
   - To install, tighten to 6 Nm (53 lb-in).

5. Remove the starter solenoid battery cable nut and position the starter solenoid battery cable aside.

- To install, tighten to 12 Nm (9 lb-ft).

6. Remove the ground cable nut and position the ground cable aside.
   - To install, tighten to 25 Nm (18 lb-ft).

7. Remove the starter motor stud bolt, bolt and the starter motor.
   - Install the starter motor upper bolt and lower stud bolts hand-tight. Tighten the upper bolt to 25 Nm (18 lb-ft), followed by the lower stud bolts to 25 Nm (18 lb-ft).

8. To install, reverse the removal procedure.

General Specifications

Item	Specification
Engine Ignition	
Firing order	1-5-4-2-6-3-7-8
Spark plug gap	1.0-1.1 mm (0.039-0.043 in)
Spark plug type	AGSP-32F
Lubricants and Chemicals	
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

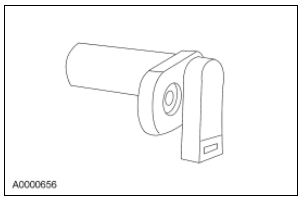
Torque Specifications

Description	Nm	lb-ft	lb-in
Evaporative emissions (EVAP) canister purge valve bracket nuts	20	15	—
Ignition coil-on-plug bolts	5	—	44
Ignition coil-on-plug cover bolts	5	—	44
Spark plugs	27	20	—

Engine Ignition

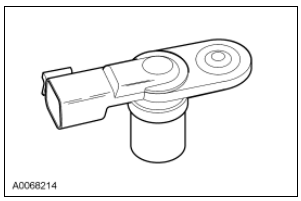
The electronic ignition (EI) system is a coil-on-plug (COP) ignition system. The COP ignition system consists of the:

- crankshaft position (CKP) sensor.
- camshaft position (CMP) sensor.
- ignition coils.
- spark plugs.



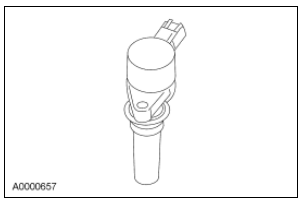
The crankshaft position sensor:

- is a variable reluctance sensor.
- is triggered by a 36-minus-1 tooth trigger wheel mounted on the crankshaft.
- provides base timing and crankshaft speed (rpm) to the powertrain control module (PCM).



The camshaft position sensor:

- sends the PCM a signal indicating camshaft position used for fuel and spark synchronization.



The 6 separate ignition coils:

- convert low voltage signals from the PCM to high voltage pulses.
- produce the high voltage pulses for the spark plugs.
- are connected directly to each spark plug.

The spark plugs:

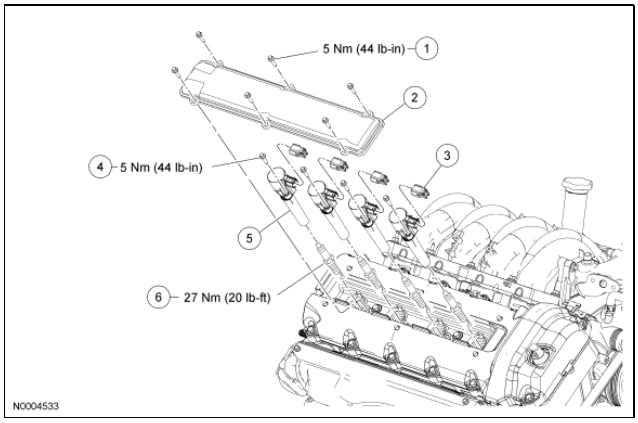
- convert a high voltage pulse into a spark which ignites the fuel and air mixture.
- originally equipped on the vehicle have a platinum-enhanced active electrode for long life.

Engine Ignition

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Engine Ignition Components — Exploded View

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	W500205	Ignition coil cover bolt (6 required)
2	12025	Ignition coil cover (2 required)
3	—	Ignition coil electrical connector (8 required) (part of 12B637)
4	W500205	Ignition coil bolt (8 required)
5	12A366	Ignition coil (8 required)
6	12405	Spark plug (8 required)

1. For additional information, refer to the procedures in this section.

Ignition Coil-On-Plug

Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal

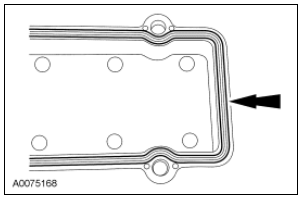
LH ignition coils

1. Remove the evaporative emissions (EVAP) canister purge valve nuts and position the valve and bracket aside.

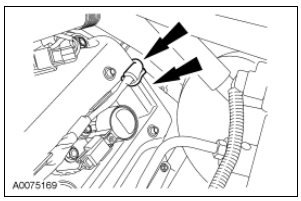
All ignition coils

2. Remove the 12 bolts and the 2 ignition coil covers.

3. Remove all silicone sealant and residue from the coil cover.



4. Remove all silicone sealant and residue from the valve cover surface and ignition coil wiring harness.



5. Disconnect the 8 ignition coil electrical connectors.

6. Remove the 8 ignition coil bolts.

7. **NOTE:** When removing the ignition coils, a slight twisting motion will break the seal and ease removal.

   Remove the 8 ignition coils.

Installation

All ignition coils

1. **NOTE:** Apply silicone brake caliper grease and dielectric compound to the inside of ignition coil boots.

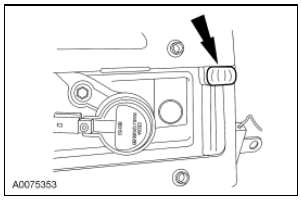
   Install the 8 ignition coils and the bolts.

   - Tighten to 5 Nm (44 lb-in).

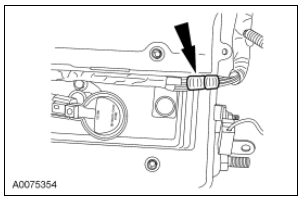
2. Connect the 8 ignition coil electrical connectors.

3. **NOTE:** Remove all dirt and moisture from the valve cover before applying silicone sealant.

   Lift up the wire harness and apply a 12.7 mm (0.5 in) bead of silicone sealant in the notch of the valve cover.



4. Set the ignition coil harness in the bead of silicone sealant and apply enough additional sealant to surround the wire harness and notch.



5. Install the ignition coil covers and the bolts.
   - Tighten to 5 Nm (44 lb-in).

LH ignition coils

6. Position the EVAP canister purge valve bracket and install the nuts.
   - Tighten to 20 Nm (15 lb-ft).

Spark Plugs

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal and Installation

1. Remove the ignition coils. For additional information, refer to Ignition Coil-On-Plug in this section.
2. **CAUTION: Only use hand tools when removing or installing the spark plugs, or damage can occur to the cylinder head or spark plug.**

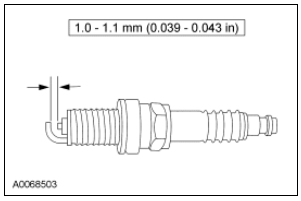
   NOTE: Use compressed air to remove any foreign material from the spark plug well before removing the spark plugs.

   Remove the 8 spark plugs.

   - To install, tighten to 27 Nm (20 lb-ft).
3. Inspect the spark plugs. For additional information, refer to Section 303-00 .
4. **NOTE:** Clean the spark plugs with a wire brush or a professional spark plug cleaner (follow the manufacturer's instructions).

   To install, reverse the removal procedure.

   - Adjust the plug gap as necessary.
   - Apply a light film of silicone brake caliper grease and dielectric compound to the inside of the coil boots before installation.



Torque Specifications

Description	Nm	lb-ft
Exhaust gas recirculation (EGR) system module bolts	25	18
EGR system module tube flange nuts	20	15

Engine Emission Control

⚠ CAUTION: Do not remove any part of the engine emission control system. Operating the engine without the engine emission control system will reduce fuel economy and engine ventilation. This will weaken engine performance and shorten engine life.

The engine emission control consists of the:

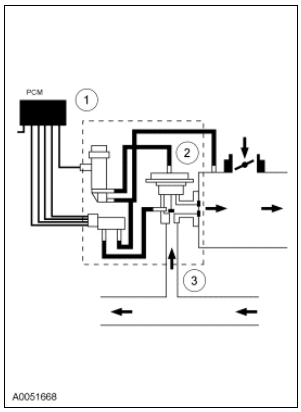
- exhaust gas recirculation (EGR) system module.

The vehicle emission control information (VECI) decal shows:

- the components of the emission control system.
- the correct vacuum hose routing.

For additional information, refer to Section 100-02 .

EGR System Components



Item	Part Number	Description
1	12A650	Powertrain control module (PCM)
2	9J459	EGR system module
3	9D475	EGR valve-to-exhaust manifold tube

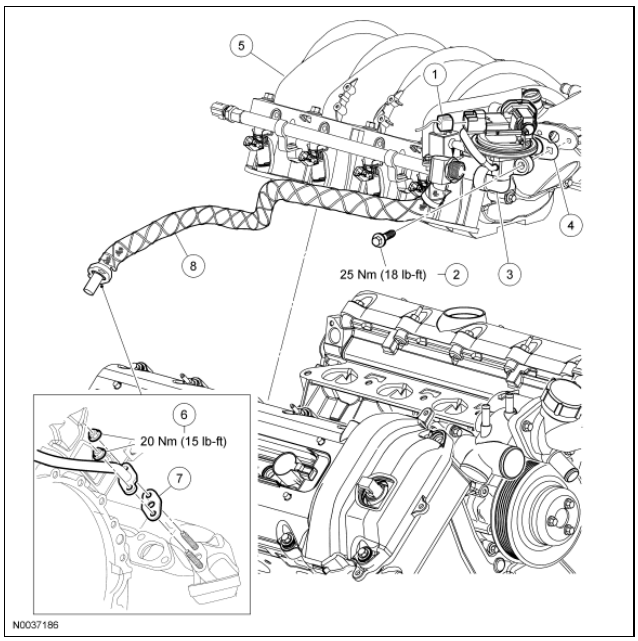
The EGR system returns a portion of the exhaust gas to the intake manifold to reduce the combustion temperature. This results in lower nitrous oxide formation.

The powertrain control module (PCM) controls the EGR vacuum regulator solenoid. The EGR vacuum regulator solenoid controls the vacuum to the EGR system module. When the EGR valve opens, exhaust gas flows to the intake manifold. The differential pressure feedback sensor measures the flow through the EGR valve from the exhaust manifold tube and sends a signal to the PCM. A metering orifice in the EGR valve-to-exhaust manifold tube restricts the flow rate when the EGR valve is open.

Engine Emission Control

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Exhaust Gas Recirculation (EGR) System Components — Exploded View



Item	Part Number	Description
1	12B637	Exhaust gas recirculation (EGR) system module connector
2	W701232	EGR bolts (2 required)
3	9Y456	EGR system module
4	9D476	EGR system module gasket
5	9424	Intake manifold assembly
6	W520413	EGR system module-to-exhaust manifold tube flange nuts (2 required)
7	9D477	EGR system module-to-exhaust manifold tube gasket
8	9D477	EGR system module-to-exhaust manifold tube

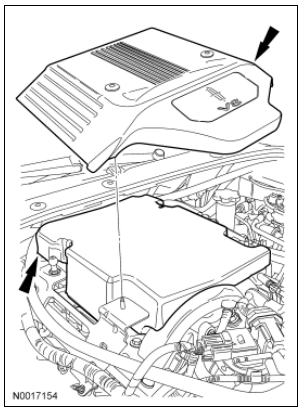
1. For additional information, refer to the procedures in this section.

Exhaust Gas Recirculation (EGR) System Module

Removal and Installation

1. ⚠ **CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Remove the engine appearance cover and the noise suppressor (if detached).



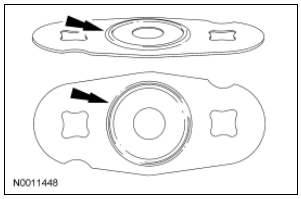
2. Disconnect the exhaust gas recirculation (EGR) system module electrical connector.

3. Remove the vacuum harness from the EGR system module.

4. Disconnect the EGR system module-to-exhaust manifold tube from the EGR system module.

5. Remove the 2 bolts and the EGR system module.
   - Remove the EGR gasket and discard.
   - Clean the EGR sealing surfaces.
   - To install, tighten to 25 Nm (18 lb-ft).

6. To install, reverse the removal procedure.
   - Install a new EGR system module gasket with the side with the raised circle facing the intake manifold.



Exhaust Gas Recirculation (EGR) System Module Tube

Removal and Installation

1. Remove the intake manifold. For additional information, refer to Section 303-01 .

2. Disconnect the 2 EGR system module-to-exhaust manifold tube flange nuts and remove the tube.
   - Remove the EGR tube-to-exhaust manifold gasket and discard.
   - Clean the EGR tube-to-exhaust manifold sealing surfaces.
   - To install, tighten to 20 Nm (15 lb-ft).

3. To install, reverse the removal procedure.
   - Install a new EGR tube-to-exhaust manifold gasket.

Torque Specifications

Description	Nm	lb-in
Air cleaner outlet pipe clamp	4	35
Air cleaner outlet pipe retaining nut	4	35
Air cleaner bolt	4	35

Intake Air Distribution and Filtering

The air intake system consists of the:

- air cleaner (ACL) inlet.
- air cleaner element.
- mass air flow (MAF) sensor.
- air cleaner outlet pipe.

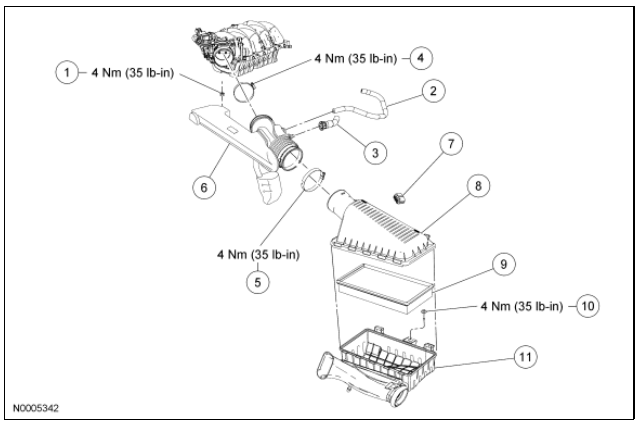
The air intake system:

- cleans intake air with a replaceable, dry-type air cleaner element.
- measures air flow and air temperature with the MAF sensor.

Intake Air Distribution and Filtering

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Intake Air System Components — Exploded View



Item	Part Number	Description
1	W705760	Air cleaner outlet pipe retaining nut
2	9C490	Chassis vacuum hose
3	9K617	Crankcase vent tube
4	9C632	Air cleaner outlet pipe clamp
5	9C632	Air cleaner outlet pipe clamp
6	9F805	Air cleaner outlet pipe
7	14A464	Mass air flow (MAF) electrical connector
8	9643	Air cleaner cover
9	9601	Air cleaner element
10	W503926	Air cleaner tray bolt
11	9A612	Air cleaner tray

1. For additional information, refer to the procedures in this section.

Air Cleaner Outlet Pipe

Removal and Installation

1. Remove the air cleaner outlet pipe retaining nut.
   - To install, tighten to 4 Nm (35 lb-in).

2. Disconnect the chassis vacuum hose from the air cleaner outlet pipe and position aside.

3. Disconnect crankcase vent tube from the air cleaner outlet pipe and position aside.

4. Remove the 2 clamps and the air cleaner outlet pipe.
   - To install, tighten to 4 Nm (35 lb-in).

5. To install, reverse the removal procedure.

Air Cleaner

Removal and Installation

1. Remove the clamp and disconnect the air cleaner outlet pipe from the air cleaner assembly.
   - To install, tighten to 4 Nm (35 lb-in).

2. Disconnect the mass air flow (MAF) electrical connector.

3. Remove the bolt and the air cleaner assembly.
   - To install, tighten to 4 Nm (35 lb-in).

4. **NOTE:** The air cleaner assembly must be removed to service the air filter element.

   If necessary, release the snaps and separate the air cleaner cover from the air cleaner tray to service the element.

5. To install, reverse the removal procedure.
   - Use the alignment tabs to correctly align the air cleaner cover to the air cleaner tray if removed.

General Specifications

Item	Specification
Lubricants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Evaporative emissions (EVAP) canister and bracket mounting bolts	9	—	80
EVAP canister purge valve mounting nuts	27	20	—

Evaporative Emissions

The evaporative emission (EVAP) system:

- is equipped with an on-board refueling vapor recovery (ORVR) system.
- prevents hydrocarbon emissions from reaching the atmosphere.
- stores fuel vapors in the EVAP canister that are generated during vehicle refueling, vehicle operation or hot soak until they can be consumed by the engine.
- routes the stored fuel vapors to the engine during engine operation.
- is controlled by the powertrain control module (PCM) which uses various sensor inputs to calculate the desired amount of purge flow. The PCM regulates the purge flow, induced by the application of intake manifold vacuum, by varying the duty cycle applied to the EVAP canister purge valve.
- has an EVAP test port for test purposes.

The fuel vapors are routed:

- from the fuel tank through the fuel vapor control valve and fuel vapor vent valve.
- to the EVAP canister through a vapor line.
- to the engine when the EVAP canister purge valve is opened by the PCM.

The fuel tank pressure (FTP) sensor:

- monitors the pressure levels in the fuel tank.
- communicates the pressure reading to the PCM during the OBD II leak test.
- is permanently attached to the fuel vapor control valve tube assembly.

The evaporative emission canister assembly:

- is located above the rear subframe.
- contains activated carbon.
- stores fuel vapors.

The fuel tank filler cap:

- relieves system pressure above 17 kPa (68.24 inches H_2O).
- relieves system vacuum below 5.65 kPa (22.68 inches H_2O).

The canister vent solenoid:

- is normally open.
- seals the EVAP system for the inspection and maintenance (I/M 240) test and OBDII leak and pressure tests.
- is mounted on the EVAP canister bracket assembly.
- is repaired as a separate item.

The EVAP canister purge valve:

- is normally closed.
- regulates purging of the EVAP canister.
- is controlled by the PCM.
- is located in the engine compartment on the LH strut tower.

The fuel vapor vent (FVV) valve:

- is permanently mounted to the fuel tank.
- prevents suspended liquid fuel from being drawn into the EVAP canister along with the fuel vapors.

The fuel vapor control valve:

- is permanently mounted to the fuel tank.
- controls fuel tank refueling fill level.
- prevents suspended liquid fuel from being drawn into the EVAP canister along with the fuel vapors.

The underbody fuel supply and vapor tube assembly:

- is located under the LH rocker panel.
- includes both the fuel supply line and the EVAP canister purge outlet tube.
- supplies fuel from the fuel pump to the fuel filter.
- routes fuel vapors from the fuel vapor control valve tube assembly to the engine compartment fuel supply and vapor tube.
- is repaired as an assembly.

The engine compartment fuel supply and vapor tube assembly:

- is located on the LH side of the engine compartment.
- supplies fuel from the fuel filter to the fuel injection supply manifold.
- routes fuel vapors from the underbody fuel supply and vapor tube assembly to the EVAP canister purge valve.
- is repaired as an assembly.

The EVAP system monitor:

- is a self-test strategy within the PCM, which tests the integrity of the EVAP system.
- monitors the EVAP system for leaks.
- monitors electronic EVAP components for irrationally high or low voltages.
- monitors for correct EVAP system operation.
- uses a negative leak test method to test and activate the EVAP system.

The EVAP test port:

- is used to connect the Evaporative Emission System Leak Tester to the EVAP system.
- is located on the EVAP canister purge valve.

The engine ON EVAP leak-check monitor:

- is executed by the individual components of the enhanced EVAP system. Intake manifold vacuum is utilized to reach a target vacuum on the EVAP system. The FTP sensor is used by the engine ON EVAP leak-check monitor to determine if the target vacuum necessary to carry out the leak-check on the EVAP system has been reached. Once target vacuum on the EVAP system is achieved, the change in EVAP system vacuum over a calibrated period of time determines if a leak exists.

The Engine Off Natural Vacuum (EONV) EVAP leak-check monitor is executed:

- once the engine ON EVAP leak-check monitor is completed and the key is turned OFF. The EONV EVAP leak-check monitor determines if a leak is present when the naturally occurring change in the fuel tank pressure or vacuum does not exceed a calibrated limit during a calibrated amount of time. A

separate, low-power consuming microprocessor in the PCM manages the EONV leak-check. The engine OFF EVAP leak-check monitor is executed by the individual components of the enhanced EVAP system.

Evaporative Emissions

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Evaporative Emission System Leak Test

Special Tool(s)

ST2617-A	VACUTEC Smoke Machine Fuel Evaporative Emission System Tester 218-0002 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Phase 1 — Leak Verification

1. Run the EVAP Test with the scan tool.
2. **NOTE:** Some small leaks may not be detected using the EVAP Test. If the system has passed the test but a leak is still suspected, then proceed to Phase 2.

   If the Evaporative Emission (EVAP) system failed the EVAP Test, then proceed to Phase 2.

Phase 2 — System Leak Check

1. Connect the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester to the EVAP system test port. For additional information, refer to the manufacturer's instructions.
2. **NOTE:** In the scan tool, the EVAP canister purge valve is referred to as the EVAP vapor management valve.

   Open the EVAP canister purge valve with the scan tool.
3. Close the canister vent solenoid with the scan tool.
4. Carefully turn the fuel tank filler cap counterclockwise until the thread disengages and position aside.
5. **NOTE:** If smoke does not exit the fuel tank filler pipe neck area after the system is pressurized, open the canister vent solenoid with the scan tool to allow the air to purge. Once smoke is seen at the canister vent solenoid, close the canister vent solenoid with the scan tool.

   Introduce smoke from the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester into the EVAP system and verify that smoke is exiting the fuel tank filler pipe neck area. For additional information, refer to the manufacturer's instructions.
6. Install the fuel tank filler cap once smoke is observed exiting the fuel tank filler pipe neck area.
7. Continue to enter smoke into the system for 60 seconds to obtain pressure.
8. Press and release the remote start button in intervals of 15 seconds ON and 15 seconds OFF while checking for exiting smoke.

9. Use the halogen light provided with the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester to follow the EVAP system path and look for smoke exiting at the source of the leak(s).

10. Repair any leaks as necessary.

11. Repeat the leak test until the system passes.

Canister Vent Solenoid Closing Procedure

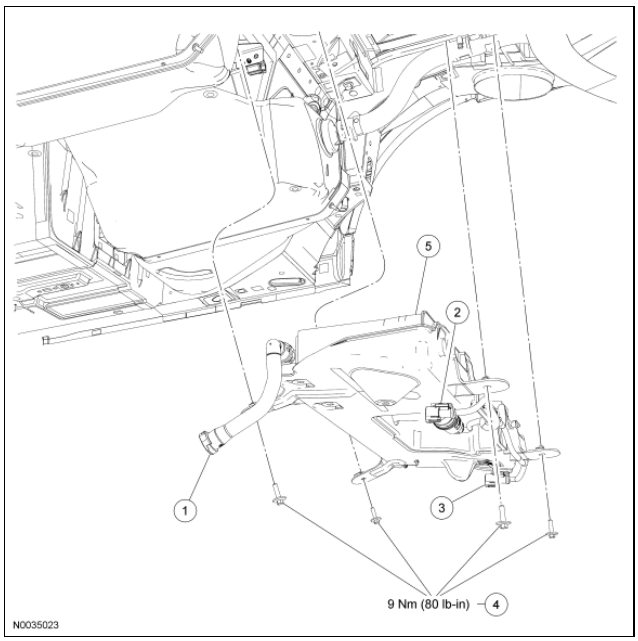
Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

NOTICE: **The canister vent solenoid must not be energized for more than 9 minutes at one time. Once the canister vent solenoid is energized and de-energized, adequate time must be allowed for the component to cool adequately. Failure to allow the component to cool may create a false failure in the diagnostics, causing unnecessary repairs.**

1. Connect the diagnostic tool and select the output test mode.
2. If parameter identification (PID) monitors are not active, select PIDs.
3. Select the fuel tank pressure (FTP) and the volts (V) PID for monitoring.
4. Select the ALL OFF mode.
5. Close the canister vent solenoid by pushing the START button on the diagnostic tool.

Evaporative Emission Canister



Item	Part Number	Description
1	—	Fuel vapor tube quick connect coupling (part of 9E857)
2	14A464	Evaporative emissions (EVAP) canister electrical connector (part of 9L468)
3	14A464	EVAP canister electrical connector (part of 9L468)
4	W503925	EVAP canister bracket assembly bolts (4 required)
5	9E857	EVAP canister assembly

Removal and Installation

⚠ WARNING: The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions can result in personal injury.

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to follow these instructions can result in personal injuries.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Remove the rear subframe. For additional information, refer to Section 502-00 .

4. Disconnect the fuel vapor tube quick connect coupling. For additional information, refer to Section 310-00 .

5. Disconnect the 2 evaporative emissions (EVAP) canister electrical connectors.

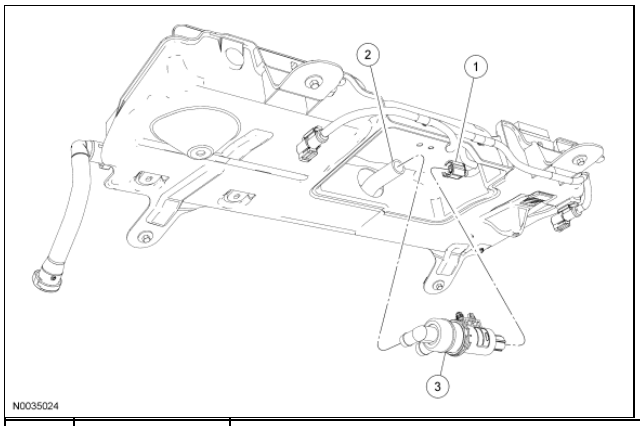
6. Remove the 4 EVAP canister bracket assembly bolts and the EVAP canister and bracket assembly.
    - To install, tighten to 9 Nm (80 lb-in).

7. To install, reverse the removal procedure.
    - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

Evaporative Emission Canister Vent Solenoid

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W-20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	14A464	Evaporative emissions (EVAP) canister vent solenoid electrical connector (part of 9L468)
2	9E616	Fuel vapor tube
3	9F945	EVAP canister vent solenoid

Removal and Installation

⚠ WARNING: The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions can result in personal injury.

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⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to follow these instructions can result in personal injuries.

1. Disconnect the battery ground cable. For additional information, refer to Section 100-02 .

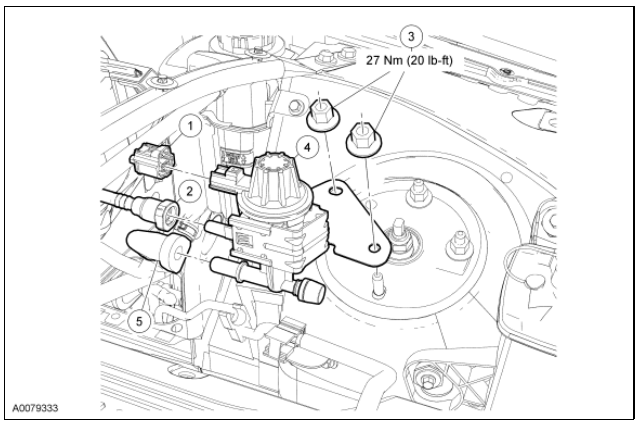
2. Disconnect the evaporative emissions (EVAP) canister vent solenoid electrical connector.
3. Disconnect the EVAP hose and remove the EVAP canister vent solenoid.
4. **NOTE:** Make sure the electrical connector harness is correctly routed.

   NOTE: To ease installation, lubricate the inside of the EVAP hose with clean engine oil.

   To install, reverse the removal procedure.

   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

Evaporative Emission Canister Purge Valve



Item	Part Number	Description
1	14A464	Evaporative emissions (EVAP) canister purge valve electrical connector
2	—	Fuel vapor tube quick connect coupling (part of 9J274)
3	W704790	EVAP canister purge valve mounting nuts (2 required)
4	9B593	EVAP canister purge valve
5	—	Fuel vapor tube quick connect coupling (part of 9J280)

Removal and Installation

⚠ WARNING: The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions can result in personal injury.

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

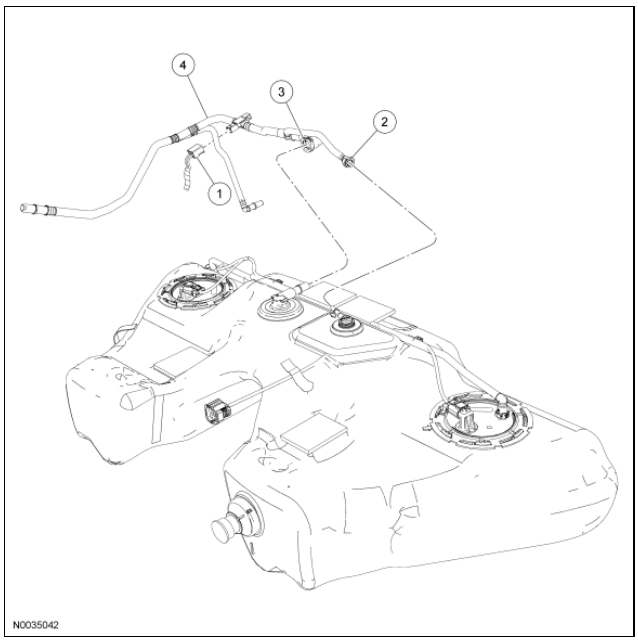
⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to follow these instructions can result in personal injuries.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the evaporative emissions (EVAP) canister purge valve electrical connector.
3. Disconnect the upper fuel vapor tube from the EVAP canister purge valve.
4. Remove the 2 EVAP canister purge valve bracket nuts.
   - To install, tighten to 27 Nm (20 lb-ft).

5. Detach the EVAP canister purge valve bracket from the studs, disconnect the lower fuel vapor tube and remove the EVAP canister purge valve.

6. To install, reverse the removal procedure.
    - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

Fuel Vapor Tube Assembly



Item	Part Number	Description
1	14A464	Fuel tank pressure sensor electrical connector (part of 14407)
2	—	Fuel vapor control tube assembly valve quick connect coupling (part of 9C047)
3	—	Fuel vapor control tube assembly valve quick connect coupling (part of 9C047)
4	9C047	Fuel vapor control tube assembly valve

Removal and Installation

⚠ WARNING: The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to follow these instructions can result in personal injuries.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. Remove the fuel tank. For additional information, refer to Section 310-01 .

3. Disconnect the fuel tank pressure sensor electrical connector.

4. Disconnect the 2 fuel vapor control tube assembly valve quick connect couplings. For additional information, refer to Section 310-00 .

5. Release the retainer clips and remove the fuel vapor control tube assembly valve from the fuel tank.

6. To install, reverse the removal procedure.
    - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

General Specifications

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (Canada CXC-51-A)	—

Torque Specifications

Description	Nm	lb-ft	lb-in
Engine wiring harness conduit nuts	8	—	70
Camshaft position (CMP) sensor bolts	10	—	89
Crankshaft position (CKP) sensor bolt	10	—	89
Powertrain control module (PCM) nuts	8	—	71
PCM bracket bolts	7	—	62
PCM electrical connectors	5	—	44
Mass air flow (MAF) sensor	2	—	18
Heated oxygen sensor (HO2S)	41	30	—
Catalyst monitor sensor	41	30	—
Knock sensor (KS) bolt	20	15	—
Cylinder head temperature (CHT) sensor	22	16	—
Fuel pressure sensor bolts	5	—	44
Variable camshaft timing (VCT) oil control solenoid bolt	7	—	62
Throttle position (TP) sensor bolts	3	—	27

Electronic Engine Controls

The electronic engine controls consist of the following:

- Powertrain control module (PCM)
- Throttle position (TP) sensor
- Two camshaft position (CMP) sensors
- Crankshaft position (CKP) sensor
- Mass air flow (MAF) sensor
- Heated oxygen sensors (HO2S)
- Catalyst monitor sensors
- Two knock sensors (KS)
- Cylinder head temperature (CHT) sensor
- Power steering pressure (PSP) switch
- Fuel pressure sensor
- Fuel temperature sensor

The PCM carries out the following functions:

- Accepts inputs from various engine sensors to compute the fuel flow rate necessary to maintain a prescribed air/fuel ratio and spark synchronization throughout the entire engine operating range.
- Outputs a command to the fuel injectors to meter the appropriate quantity of fuel.

The TP sensors:

- send the PCM a signal indicating the throttle plate angle.
- are the main input to the PCM from the driver.

The CMP sensors:

- send the PCM a signal indicating camshaft position used for fuel and spark synchronization.

The CKP sensor:

- sends the PCM a signal indicating crankshaft position.
- is essential for calculating spark timing.

The MAF sensor:

- sends the PCM a signal indicating mass airflow rate of air entering the engine.

The front HO2S:

- creates a voltage signal dependent on exhaust oxygen content.
- provides feedback information to the PCM used to calculate fuel delivery.

The catalyst monitor sensors:

- monitor oxygen content after it flows through the catalytic converter.
- provide a voltage signal to the PCM used to calculate catalytic converter integrity.

The KS:

- is used to detect engine detonation.
- sends a voltage signal to the PCM.
- is able to provide a signal that retards the ignition timing, if necessary.

The cylinder head temperature sensor:

- is mounted into the wall of the cylinder head and is not connected to any coolant passages.
- sends a signal to the PCM indicating the cylinder head temperature.
    - ♦ If the temperature exceeds approximately 121°C (250°F), the PCM disables half the fuel injectors at a time. The PCM will alternate which fuel injectors are disabled every 32 engine cycles. The cylinders that are not being fuel injected act as air pumps to aid in engine cooling.
    - ♦ If the temperature exceeds approximately 166°C (330°F), the PCM disables all of the fuel injectors until the engine temperature drops below approximately 154°C (310°F).
    - ♦ The coolant temperature gauge pointer will read fully hot.
    - ♦ The check gauge warning indicator will illuminate and DTC's are set.

The PSP switch:

- monitors the outlet pressure of the power steering pump and is calibrated to both an actuation and release pressure setting.
- increases the outlet pressure to match the severity of the turn maneuver.

The fuel pressure sensor:

- sends the PCM a signal indicating fuel pressure.
    - ♦ The PCM uses the fuel pressure sensor signal to maintain the fuel liquid pressure in the fuel line which reduces the fuel vapor pressure in the fuel line.

The fuel temperature sensor:

- sends the PCM a signal indicating fuel temperature.
    - ♦ The PCM uses the fuel temperature sensor signal to help maintain a prescribed air/fuel ratio and spark synchronization throughout the entire engine operating range.

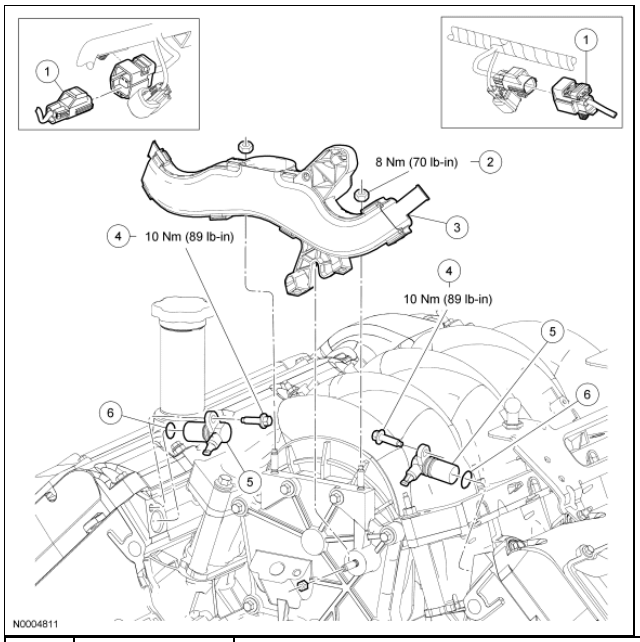
Electronic Engine Controls

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Camshaft Position (CMP) Sensor

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A



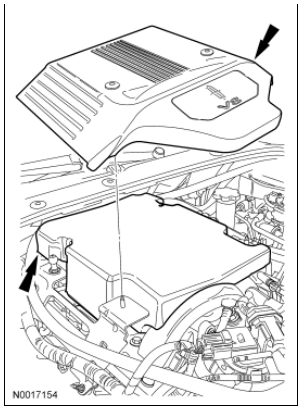
Item	Part Number	Description
1	14A464	Camshaft position (CMP) sensor electrical connectors (2 required) (part of 12B637)
2	W520101	Engine wiring harness conduit nut (3 required)
3	—	Engine wiring harness conduit (part of 12B637)
4	W500214	CMP sensor bolts (2 required)
5	6B288	CMP sensors (2 required)
6	—	O-ring seals (2 required)

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. ⚠ **CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

Remove the engine appearance cover and the noise suppressor (if detached).



3. Disconnect the 2 camshaft position (CMP) sensor electrical connectors.

4. Remove the ground strap nut and position the ground strap aside.
   - To install, tighten to 10 Nm (89 lb-in).

5. Remove the 3 nuts and position the wiring harness conduit aside.
   - To install, tighten to 8 Nm (70 lb-in).

6. Remove the 2 bolts and the LH and RH CMP sensors.
   - To install, tighten to 10 Nm (89 lb-in).
   - Inspect and install new O-ring seals as necessary.

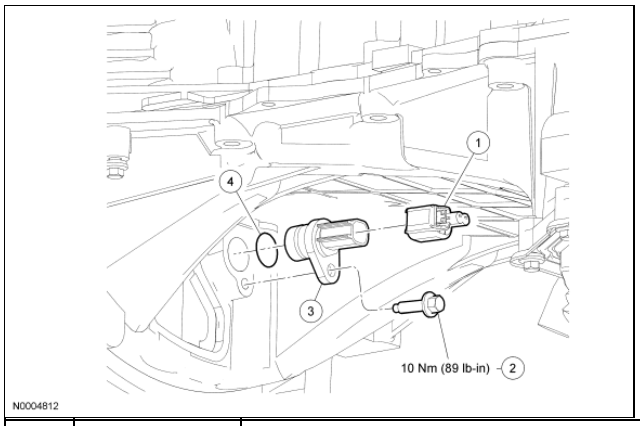
7. **NOTE:** Lubricate the O-ring seals with clean engine oil.

To install, reverse the removal procedure.

Crankshaft Position (CKP) Sensor

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	14A464	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	W500214	CKP sensor bolt
3	6C315	CKP sensor
4	—	O-ring seal

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

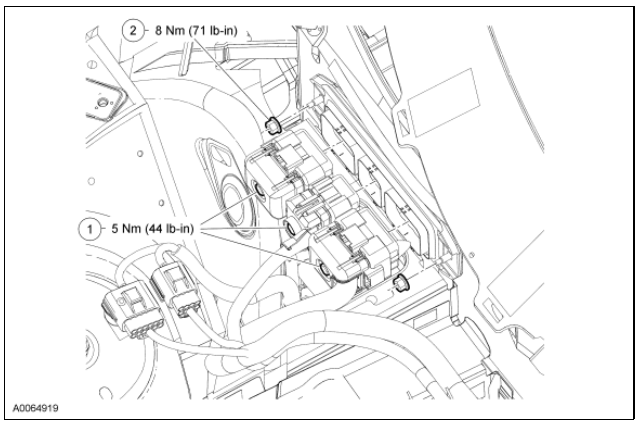
3. Disconnect the crankshaft position (CKP) sensor electrical connector.

4. Remove the bolt and the CKP sensor.
   - To install, tighten to 10 Nm (89 lb-in).
   - Inspect and install a new O-ring seal as necessary.

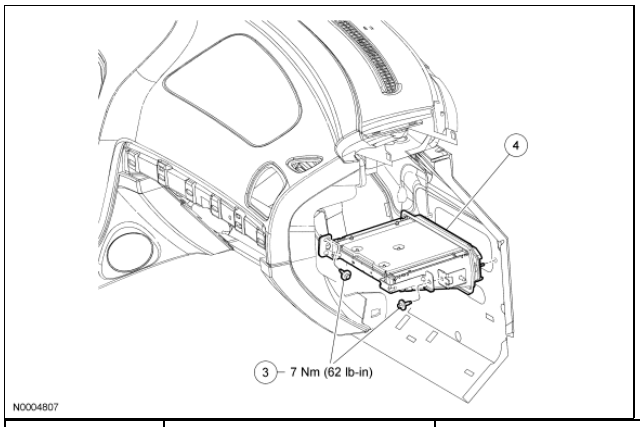
5. **NOTE:** Lubricate the O-ring seal with clean engine oil.

   To install, reverse the removal procedure.

Powertrain Control Module (PCM)



Item	Part Number	Description
1	14A464	Powertrain control module (PCM) electrical connectors (3 required)
2	N621927	PCM nuts (2 required)



Item	Part Number	Description
3	606625	PCM bracket bolts (2 required)
4	031400	PCM and bracket

Removal

1. **NOTE:** PCM replacement DOES NOT require new keys or programming of keys.

   Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. For additional information, refer to Section 418-01 .

2. Remove the fresh air inlet duct. For additional information, refer to Section 412-01 .

3. Remove the glove compartment.

4. Disconnect the 3 PCM electrical connectors.

5. Remove the 2 PCM nuts.

6. Remove the 2 PCM bracket bolts.

7. Remove the PCM and bracket as an assembly through the glove compartment opening.

Installation

1. Install the PCM and bracket as an assembly through the glove compartment opening.

2. Install the 2 PCM bracket bolts.
   - Tighten to 7 Nm (62 lb-in).

3. Install the 2 PCM nuts.
   - Tighten to 8 Nm (71 lb-in).

4. Connect the 3 PCM electrical connectors.
   - Tighten to 5 Nm (44 lb-in).

5. Install the glove compartment.

6. Install the fresh air inlet duct. For additional information, refer to Section 412-01 .

7. Restore the module configuration. Carry out the module configuration restore steps of the Programmable Module Installation procedure. For additional information, refer to Section 418-01 .

8. Reprogram the passive anti-theft system (PATS). Carry out the Parameter Reset procedure. For additional information, refer to Section 419-01B .

Throttle Position (TP) Sensor

Removal

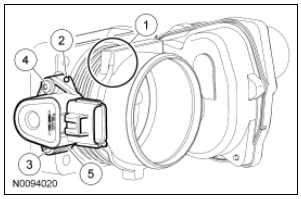
1. Remove the Throttle Body (TB). For additional information, refer to Section 303-04 .

2. *NOTICE:* **Do not put direct heat on the Throttle Position (TP) sensor or any other plastic parts because heat damage may occur. Damage may also occur if Electronic Throttle Body (ETB) temperature exceeds 120°C (248°F).**

   NOTE: Do not use power tools.

   Remove the TP sensor.

   1. Using a suitable heat gun, apply heat to the top of the ETB until the top TP sensor bolt ear reaches approximately 55°C (130°F), this should take no more than 3 minutes using an 1,100-watt heat gun. The heat gun should be about 25.4 mm (1 in) away from the ETB .
   2. Monitor the temperature of the top TP sensor bolt ear on the ETB with a suitable temperature measuring device, such as a digital temperature laser or infrared thermometer, while heating the ETB .
   3. Using hand tools, quickly remove the bolt farthest from the heat source first and discard.
   4. Using hand tools, remove the remaining bolt and discard.
   5. Remove and discard the TP sensor.



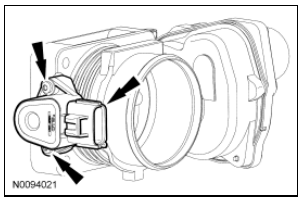
Installation

1. **NOTE:** When installing the new TP sensor, make sure that the radial locator tab on the TP sensor is aligned with the radial locator hole on the ETB .

   NOTE: Do not use power tools.

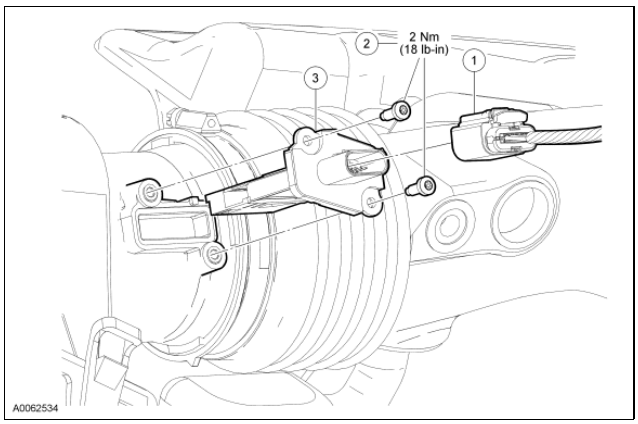
   Install the new TP sensor.

   - Using hand tools, install the 2 new bolts.
     - ♦ Tighten to 3 Nm (27 lb-in).



2. Install the TB . For additional information, refer to Section 303-04 .

Mass Air Flow (MAF) Sensor



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	—	MAF sensor bolts (2 required)
3	12B605	MAF sensor

Removal and Installation

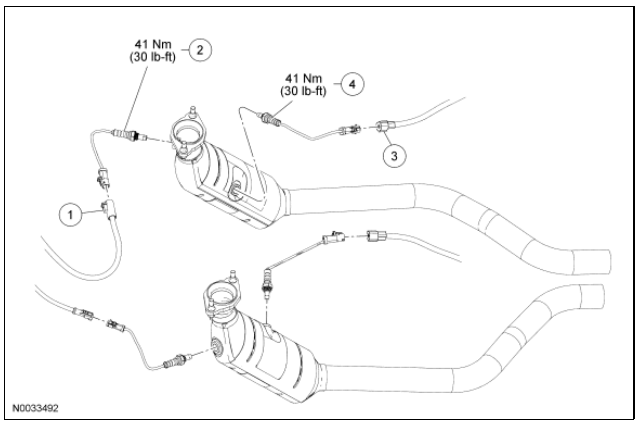
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

2. Disconnect the mass air flow (MAF) sensor electrical connector.

3. Remove the 2 bolts and the MAF sensor.
   - To install, tighten to 2 Nm (18 lb-in).

4. To install, reverse the removal procedure.

Heated Oxygen Sensor (HO2S) and Catalyst Monitor Sensor — Exploded View

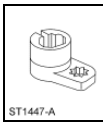


Item	Part Number	Description
1	14A464	Heated oxygen sensor (HO2S) electrical connector (part of 12B637) (2 required)
2	9G472	HO2S (2 required)
3	14A464	Catalyst monitor sensor electrical connector (part of 12B637) (2 required)
4	9G444	Catalyst monitor sensor (2 required)

1. For additional information, refer to the procedures in this section.

Heated Oxygen Sensor (HO2S)

Special Tool(s)

 ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

Material

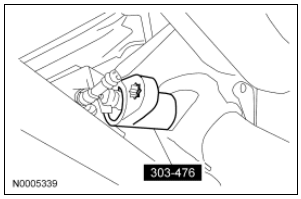
Item	Specification
Penetrating and Lock Lubricant XL-1 (Canada CXC-51-A)	—
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the heated oxygen sensor (HO2S) electrical connector.
4. **NOTE:** If necessary, lubricate the HO2S with lock lubricant to aid in removal.

   Remove the HO2S from the exhaust manifold using the special tool.

   - To install, tighten to 41 Nm (30 lb-ft).



5. To install, reverse the removal procedure.
   - Apply a light coat of anti-seize lubricant to the threads of the HO2S.

Catalyst Monitor Sensor

Special Tool(s)

ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

Material

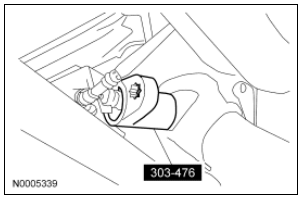
Item	Specification
Penetrating and Lock Lubricant XL-1 (Canada CXC-51-A)	—
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the catalyst monitor sensor (CMS) electrical connector.
4. **NOTE:** If necessary, lubricate the CMS with lock lubricant to aid in removal.

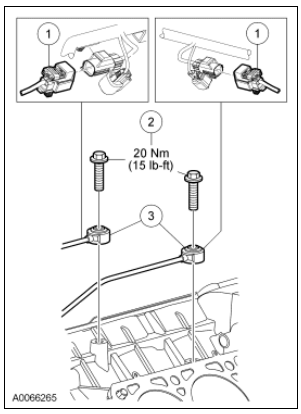
   Using the special tool, remove the CMS from the exhaust manifold.

   - To install, tighten to 41 Nm (30 lb-ft).



5. To install, reverse the removal procedure.
   - Apply a light coat of anti-seize lubricant to the threads of the CMS.

Knock Sensor (KS)



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (2 required)
2	W500310	KS bolts (2 required)
3	12A699	KS (2 required)

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

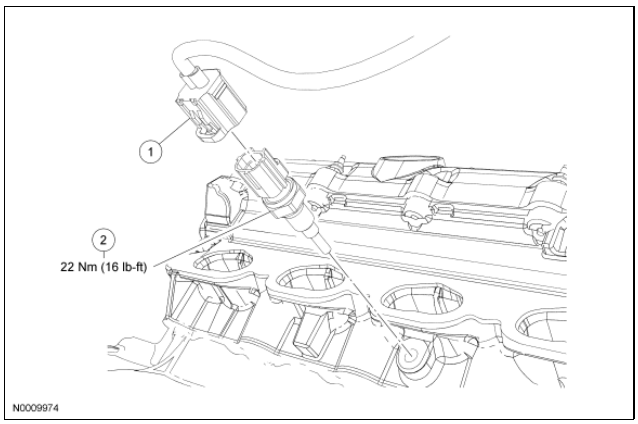
2. Remove the intake manifold. For additional information, refer to Section 303-01 .

3. Disconnect the 2 knock sensor (KS) electrical connectors.

4. Remove the 2 bolts and the 2 KS.
   - To install, tighten to 20 Nm (15 lb-ft).

5. To install, reverse the removal procedure.

Cylinder Head Temperature (CHT) Sensor



Item	Part Number	Description
1	—	Cylinder head temperature (CHT) sensor electrical connector (part of 6G004)
2	6G004	CHT sensor

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Remove the intake manifold. For additional information, refer to Section 303-01 .
3. Disconnect the cylinder head temperature (CHT) sensor electrical connector.
4. **NOTE:** The tip of the CHT contacts the cylinder head at the bottom of the hole. When removed, it will be slightly crushed. This is a normal condition.

   Remove and discard the CHT.

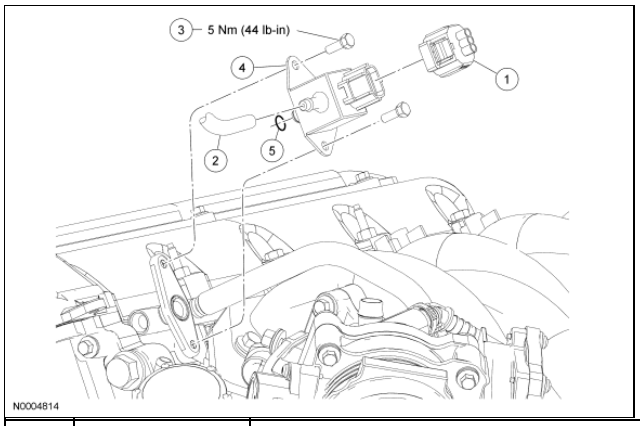
   - To install, tighten to 22 Nm (16 lb-ft).

5. To install, reverse the removal procedure.
   - The CHT is not to be reused. Always install a new sensor.

Fuel Pressure Sensor

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	14A464	Fuel pressure sensor electrical connector (part of 12B637)
2	9E499	Fuel pressure sensor vacuum tube
3	—	Fuel pressure sensor bolt (2 required)
4	9F972	Fuel pressure sensor
5	—	O-ring seal

Removal and Installation

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and can be ignited. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before working on or disconnecting any of the fuel lines or fuel system components the fuel system pressure must be relieved to prevent accidental spraying of fuel, which can cause personal injury or a fire hazard.

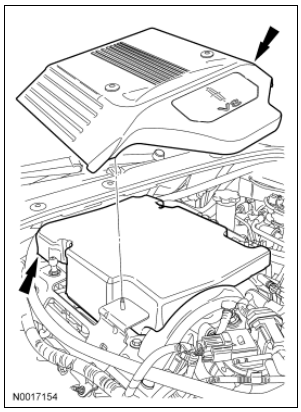
1. Release the fuel system pressure. For additional information, refer to Section 310-00 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. ⚠ **CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise**

suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.

Remove the engine appearance cover and the noise suppressor (if detached).



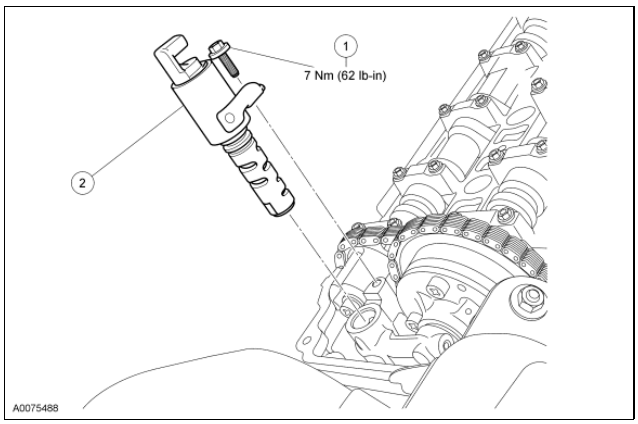
4. Disconnect the fuel pressure sensor electrical connector and vacuum tube.

5. Remove the 2 bolts and the fuel pressure sensor.
   - To install, tighten to 5 Nm (44 lb-in).
   - Inspect and install a new O-ring seal as necessary.

6. **NOTE:** Lubricate the O-ring seal with clean engine oil.

   To install, reverse the removal procedure.

Variable Camshaft Timing Oil Control Solenoid



Item	Part Number	Description
1	W500013	Variable camshaft timing (VCT) oil control solenoid bolt
2	6B297	VCT oil control solenoid

Removal and Installation

1. Remove the LH or RH valve cover. For additional information, refer to Section 303-01 .

2. Remove the bolt and the variable camshaft timing (VCT) oil control solenoid.
   - To install, tighten to 7 Nm (62 lb-ft).

3. To install, reverse the removal procedure.

General Specifications

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL2	ESE-M12A4-A
Penetrating and Lock Lubricant XL1 (Canada CXC-51-A)	—

Alignment Specifications

Item	LH	RH	Split
Front			
Caster	8.10° ± 0.50°	8.10° ± 0.50°	0° ± 0.75°
Camber	-0.15° ± 0.50°	-0.15° ± 0.50°	0° ± 0.75°
Toe @ curb ride height (positive value is toe-in, negative value is toe-out)	+ 0.08°	+ 0.08°	+0.16° ± 0.25°
Rear			
Camber	-1.0° ± 0.75°	-1.0° ± 0.75°	0° ± 0.75°
Toe @ curb ride height (positive value is toe-in, negative value is toe-out)	0.12° ± 0.25°	0.12° ± 0.25°	0.24° ± 0.25°

General Specifications

Item	Specification
Ride Height	
Front	35.5 mm (1.4 in) ± 8 mm (0.32 in)
Rear	25.8 mm (1.02 in) ± 8 mm (0.32 in)
Ball Joint Deflection	
Lower ball joint	0-0.2 mm (0-0.008 in)
Upper ball joint	0-0.2 mm (0-0.008 in)

Torque Specifications

Description	Nm	lb-ft
Front Suspension		

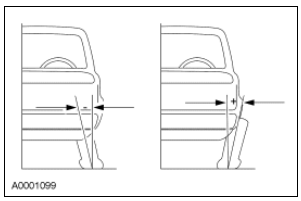
Caster adjustment cam nut	175	129
Camber adjustment cam nut	175	129
Inner tie-rod jam nut	55	41
Power steering gear nuts and bolts	90	66
Rear Suspension		
Toe link nut (outer)	55	41
Toe link nut (inner)	70	52
Toe link jam nut	55	41

Suspension System

Camber, caster and toe are adjustable on the front suspension system. Only the toe is adjustable on the rear suspension system. Camber and caster are adjusted by means of eccentric cams on the lower control arm mounting bolts. The front toe is adjusted by use of the front wheel spindle tie rod. The rear toe is adjusted by the use of toe link assemblies connecting the knuckles to the rear subframe.

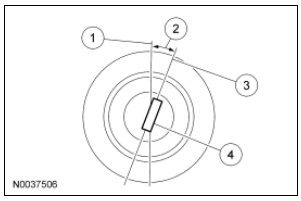
Camber

Negative and Positive Camber



Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct effect on tire wear.

Caster

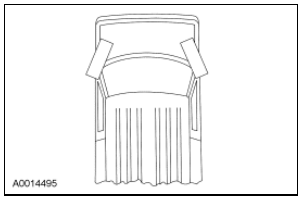


Item	Description
1	True vertical
2	Positive caster angle
3	Steering axis
4	Ball joint centerline

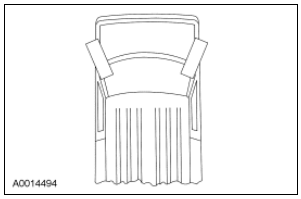
Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications in this section will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

Toe

Positive Toe (Toe-In)



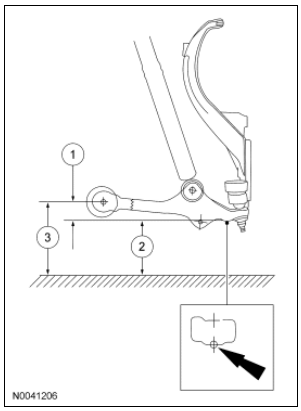
Negative Toe (Toe-Out)



The vehicle toe setting affects tire wear and directional stability.

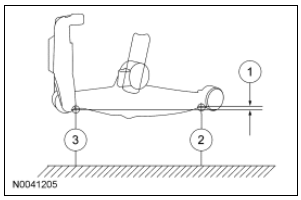
Ride Height

Front Ride Height Measurement



Item	Description
1	Ride height = B-A
2	Measurement A
3	Measurement B

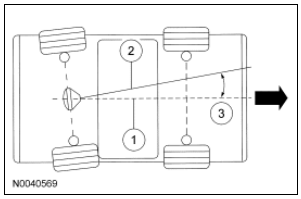
Rear Ride Height Measurement



Item	Description
1	Ride height = A-B

2	Measurement A
3	Measurement B

Thrust Angle (Dogtracking)



Item	Description
1	Vehicle centerline
2	Axle centerline
3	Rear thrust angle

Incorrect rear thrust angle (also known as dogtracking) is the condition in which the independent rear suspension (IRS) system is not square to the chassis. Heavily crowned roads can give the illusion of dogtracking.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or the steering correction is completed.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and will require constant steering input in the opposite direction to counteract the effect.
- Drift/pull may be induced by conditions external to the vehicle (wind, road camber).

Poor Groove Feel

Poor groove feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center."

- Under 20 degrees of turn, most of the turning effort that builds up comes from the mesh of gear teeth in the steering gear. In this range, the steering wheel is not yet turned enough to feel the effort from the self-aligning forces at the road wheel or tire patch.
- In the diagnosis of a roadability problem, it is important to understand the difference between wander and poor groove feel.

Suspension System

Inspection and Verification

1. Road test.
   - Verify the customer's concern by carrying out a road test on a smooth road. If any vibrations are apparent, refer to Section 100-04 .

2. Inspect tires.
   - Check the tire pressure with all normal loads in the vehicle and the tires cold. Refer to the vehicle certification (VC) label. For additional information, refer to Section 100-01 .
   - Verify that all tires are sized to specification. For additional information, refer to Section 204-04 .
   - Inspect the tires for incorrect wear and damage. Install new tires as necessary.

3. Inspect chassis and underbody.
   - Remove any excessive accumulation of mud, dirt or road deposits from the chassis and underbody.

4. Inspect for aftermarket equipment.
   - Check for aftermarket changes to the steering, suspension, wheel and tire components (such as competition, heavy duty, etc.) The specifications shown in this manual do not apply to vehicles equipped with aftermarket equipment.

Visual Inspection Chart

Mechanical
• Front wheel bearing(s) • Loose or damaged front or rear suspension components • Loose, damaged or missing suspension fastener(s) • Incorrect spring usage • Damaged or sagging spring(s) • Damaged or leaking shock absorber(s) • Worn or damaged suspension bushing(s) • Loose, worn or damaged steering system components • Damaged axle components

5. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.

6. If the fault is not visually evident, determine the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Component Tests

Ball Joint Inspection

1. Prior to inspecting the ball joints for wear, inspect the wheel bearings. For additional information, refer to Section 100-04 .

2. **NOTE:** In order to get accurate measurements, the suspension must be in full rebound with the weight of the vehicle supported by the frame.

   Raise and support the vehicle by the frame to allow the wheels to hang in the rebound position.

3. Inspect the ball joint and ball joint boot for damage.
   - If the ball joint or ball joint boot is damaged, install a new ball joint. For additional information, refer to Section 204-01 .

NOTE: Carry out Steps 4-6 to inspect the lower ball joint. Carry out Steps 7-9 to inspect the upper ball joint.

4. ⚠ **CAUTION: Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative movement. Suspension damage can occur. The use of tools or equipment will also create relative movement that may not exists when using hand force. Relative movement must be measured using hand force only.**

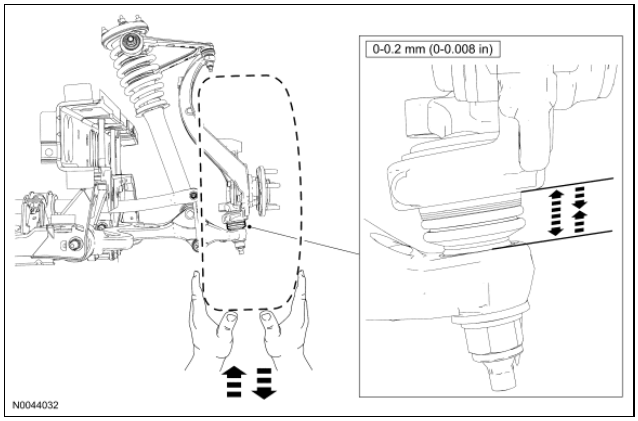
   NOTE: The weight of the wheel and tire assembly must be overcome to get an accurate measurement on the dial indicator.

   Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the wheel and tire assembly by hand. Note any relative vertical movement between the wheel knuckle and lower arm at the lower ball joint

   - If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.
   - If relative movement is found, continue with Step 5.

5. **NOTE:** In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis (center line) of the ball joint.

   To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the lower control arm and the wheel knuckle or ball joint stud.

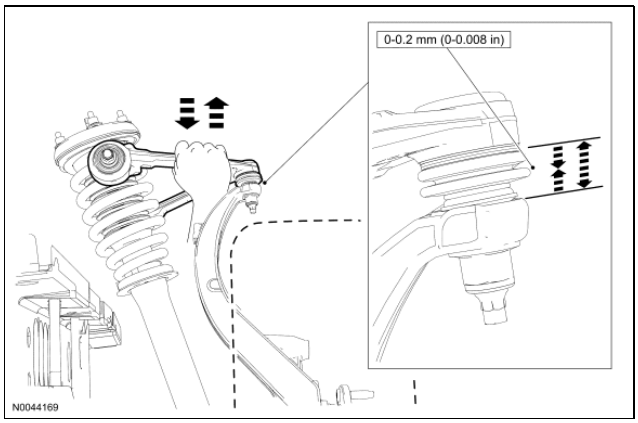


6. Measure the ball joint deflection, while an assistant pushes up and pulls down on the wheel and tire assembly, by hand.
    - If the deflection exceeds the specification, a new ball joint must be installed. For additional information, refer to Section 204-01 .
    - If the deflection meets the specification, continue with the procedure.

7. ⚠ **CAUTION: Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative movement or suspension damage can occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.**

    Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the upper control arm by hand. Note any relative vertical movement between the wheel knuckle and upper arm at the upper ball joint.

    - If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.
    - If relative movement is found, continue with Step 8.



8. **NOTE:** In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis of the ball joint.

    To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the upper control arm and the wheel knuckle or ball joint stud.

9. Measure the ball joint deflection, while an assistant pushes up and then pulls down on the upper control arm, by hand.
    - If the deflection exceeds the specification, a new ball joint must be installed. For additional information, refer to Section 204-01 .
    - If the deflection meets the specification, no further action is required.

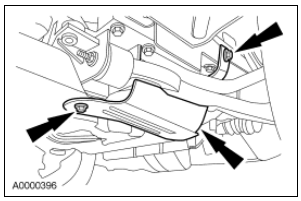
Camber and Caster Adjustment

NOTE: If the vehicle is equipped with hex head bolts in the lower control arm, new cam bolts and lock nuts must be installed before adjusting the cast and camber.

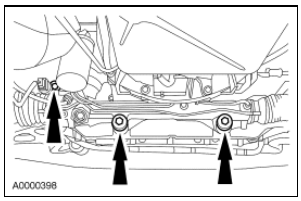
NOTE: The camber and caster adjustment for the LH side is shown. The procedure for adjusting the RH side is similar.

Vehicles without camber and caster adjustment cam bolts

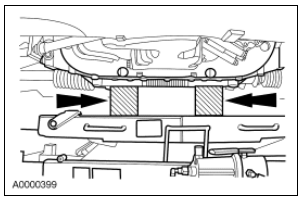
1. Remove the 2 splash shield bolts, the pushpin and the splash shield.



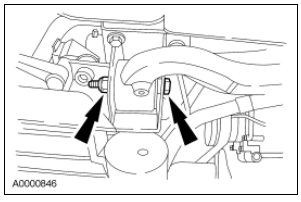
2. Remove discard the steering gear lock nuts and bolts.



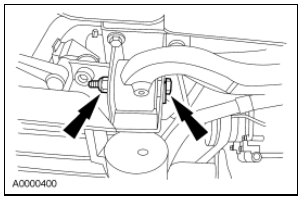
3. Raise and support the front end and the No. 2 crossmember.
   - Position two 4 in. x 4 in. pieces of wood between the No. 2 crossmember and the lifting device.



4. Remove and discard the front caster hex head bolt and nut.

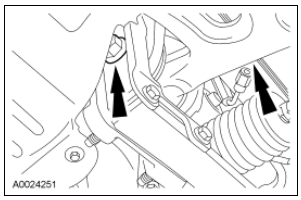


5. Loosely, install the caster adjustment cam bolt and a new lock nut.
   - The bolt must be installed from the rear as shown.
   - Install the bolt with the cam lobe down.
   - The cam must be seated between the cam guides on the No. 1 crossmember.

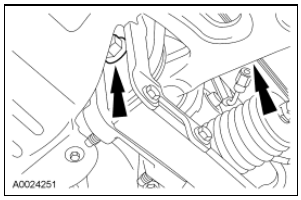


6. Position the steering gear aside.

7. Remove and discard the rear camber hex-head bolt and nut and remove the I-brace bracket.

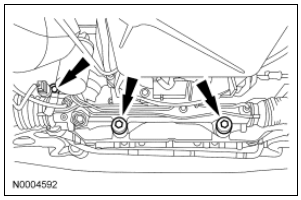


8. Loosely, install the camber adjustment cam bolt, a new lock nut and the I-brace bracket (if equipped).
   - The bolt must be installed from the rear as shown.
   - Install the bolt with the cam lobe down.
   - The cam must be seated in the groove in the No. 2 crossmember.



9. Lower the front end.

10. Install new steering gear bolts and new lock nuts.
    - Tighten to 90 Nm (66 lb-ft).

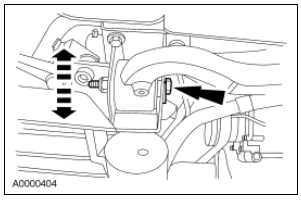


All vehicles

11. Using alignment equipment and the manufacturer's instructions, measure the camber and caster.

Vehicles requiring caster adjustment

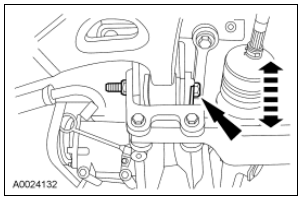
12. Rotate the caster adjustment cam bolt (front) to adjust the caster.



13. Recheck the caster settings, adjust as necessary.

Vehicles requiring camber adjustment

14. Rotate the camber adjustment cam bolt (rear) to adjust the camber.

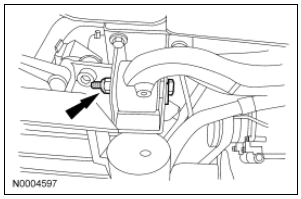


15. Recheck the camber settings, adjust as necessary.

All vehicles

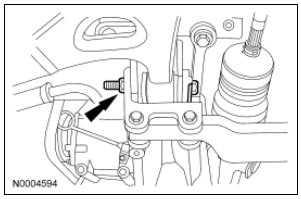
16. **⚠ CAUTION: Do not tighten until the weight of the vehicle is resting on the wheel and tire assemblies.**

    Tighten the caster adjustment cam nut to 175 Nm (129 lb-ft).

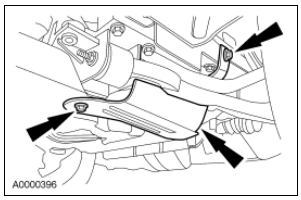


17. **⚠ CAUTION: Do not tighten until the weight of the vehicle is resting on the wheel and tire assemblies.**

    Tighten the camber adjustment cam nut to 175 Nm (129 lb-ft).



18. Install the splash shield, the pushpin and the 2 bolts.

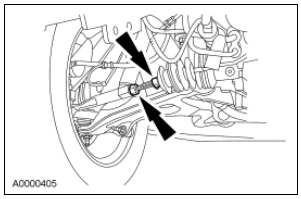


19. Check and, if necessary, adjust the front toe.

Toe Adjustment

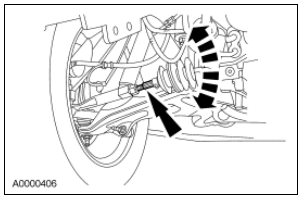
Front Toe Adjustment

1. Using alignment equipment and the manufacturer's instructions, measure the toe.
2. Start the engine and center the steering wheel.
3. Turn the engine OFF and, using a suitable holding device, lock the steering wheel in the straight-ahead position.
4. Loosen the tie-rod jam nuts and remove the steering gear bellows clamps.

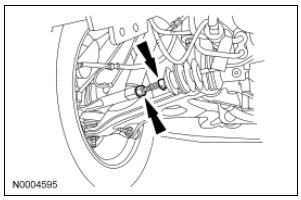


5. **NOTE:** Do not allow the steering gear bellows to twist when the front wheel spindle inner tie rod is rotated.

   Rotate the front wheel spindle inner tie rods.



6. Tighten the tie-rod jam nuts. Install the steering gear bellows clamps.
   - Tighten to 55 Nm (41 lb-ft).



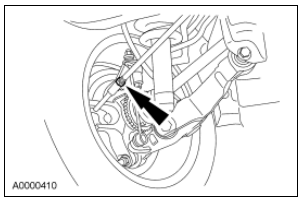
7. Recheck the toe settings and adjust if necessary.

Rear Toe Adjustment

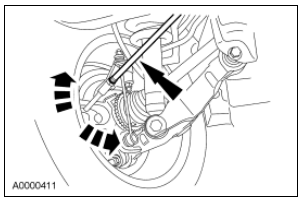
1. Using alignment equipment and the manufacturer's instructions, measure the toe.
2. Start the engine and center the steering wheel.

3. Turn the engine OFF and, using a suitable holding device, lock the steering wheel in the straight-ahead position.

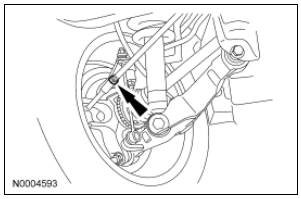
4. Loosen the toe link jam nut.



5. Rotate the toe link to adjust the toe.



6. Tighten the toe link jam nut.
   - Tighten to 55 Nm (41 lb-ft).



7. Recheck the toe settings and adjust if necessary.

General Specifications

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (Canada CXC-51-A)	—
Threadlock 262 TA-26	WSK-M2G351-A6

Torque Specifications

Description	Nm	lb-ft	lb-in
Front Suspension			
Brake caliper anchor plate bolt	103	76	—
Air conditioning line bracket bolt	9	—	80
Brake master cylinder nuts	25	18	—
Evap canister purge valve nuts	28	21	—
Upper arm-to-body nuts	48	35	—
Upper ball joint nut	90	66	—
Lower arm-to-frame nuts	175	129	—
Lower ball joint nut	200	148	—
Stabilizer bar bracket bolts	55	41	—
Stabilizer bar link nuts	55	41	—
Tie-rod end nut	80	59	—
Wheel hub bolt	90	66	—
Shock absorber lower nut	175	129	—
Shock absorber upper mount nuts	28	21	—
Shock absorber rod	50	37	—
Power steering gear nuts	90	66	—

Front Suspension

⚠ WARNING: All vehicles are equipped with gas-pressurized shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component servicing. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Suspension fasteners are critical parts because they can affect the performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during assembly to make sure of correct retention of these parts. Never attempt to heat, quench or straighten any front suspension part. Install a new part.

The front suspension consists of the following components:

- Front upper suspension arm and bushing
- Front lower suspension arm and bushing
- Front shock absorber and spring assembly
- Front stabilizer bar
- Front stabilizer bar bushings
- Front stabilizer bar brackets
- Front stabilizer bar links
- Front wheel knuckle
- Front wheel hub and bearing
- Front wheel studs

The front suspension camber and caster adjustment is carried out by:

- adjusting cam bolts on the lower suspension arm. Refer to Section 204-00 .

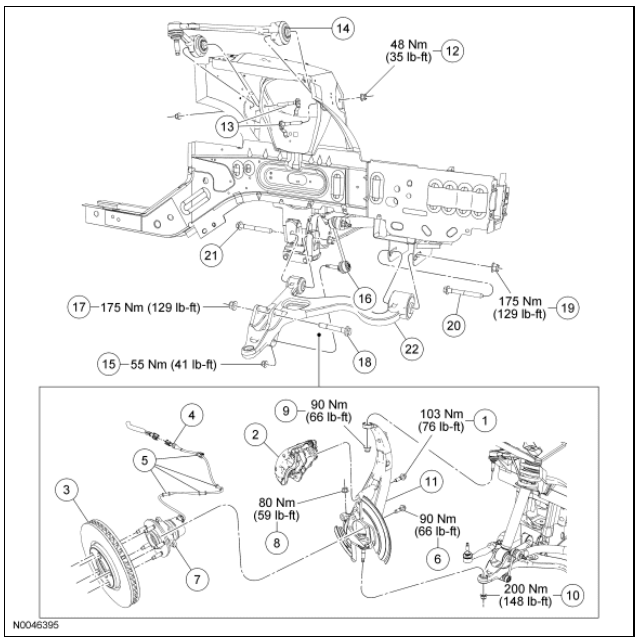
The front suspension toe adjustment is carried out by:

- adjusting the front wheel spindle inner tie rods. Refer to Section 204-00 .

Front Suspension

Refer to Section 204-00 .

Front Suspension — Exploded View



Item	Part Number	Description
1	W706921	Brake caliper anchor plate bolt (2 required)
2	2B120	Brake caliper assembly
3	1125	Brake disc
4	—	Speed sensor electrical connector (part of 2C204)
5	—	Speed sensor harness retainers (part of 2C204)
6	W705539	Wheel hub bolt (4 required)
7	1104	Wheel bearing and hub assembly
8	W520214	Tie-rod end nut
9	W520214	Upper ball joint nut
10	W708553	Lower ball joint nut
11	3K185	Wheel knuckle
12	W520213	Upper arm-to-body nut (2 required)
13	W706005	Upper arm-to-body bolts (2 required)
14	3084 RH/ 3085 LH	Upper arm
15	W520213	Stabilizer bar link lower nut
16	5K483	Stabilizer bar link
17	W520215	Shock absorber lower nut
18	W705552	Shock absorber lower bolt
19	W520215	Lower arm-to-frame nut (2 required)
20	W706993	Lower arm-to-frame bolt
21	W706993	Lower arm-to-frame bolt
22	3078 RH/ 3079 LH	Lower arm

1. For additional information, refer to the procedures in this section.

Wheel Bearing and Wheel Hub

Material

Item	Specification
Penetrating and Lock Lubricant XL-1 (Canada CXC-51-A)	—
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A

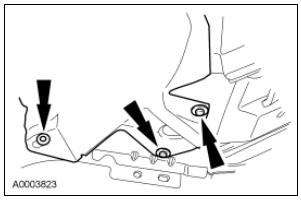
Removal

⚠ **CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

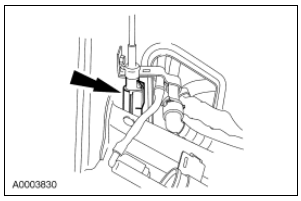
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the brake disc. For additional information, refer to Section 206-03 .

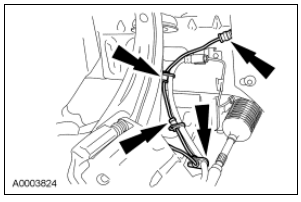
3. Remove the retainers, then position aside the inner fender skirt.



4. Move the inner fender skirt aside and disconnect the anti-lock brake (ABS) sensor.



5. Detach the ABS sensor wire from the retainers.



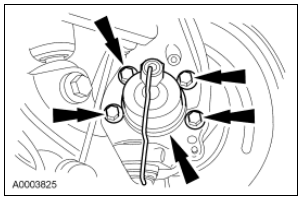
6. ⚠ **CAUTION: The wheel hub and bearing is not pressed into the wheel knuckle. Do not use a slide hammer, or strike the back of the wheel hub and bearing to remove a stuck wheel hub and bearing. Damage to the bearing or the wheel hub will occur.**

   NOTE: If necessary, clean any rust or corrosion from the back of the wheel hub and bearing and lubricate the wheel hub and bearing with lock lubricant.

   NOTE: Do not remove the ABS sensor and wire from the hub and bearing unless a new ABS sensor and wire is being installed. If the ABS sensor is separated from the hub and bearing, make sure the O-ring is in place and is not worn or damaged. Install a new O-ring if necessary.

   Remove the 4 wheel hub bolts, then remove the wheel hub and bearing assembly. Discard the bolts.

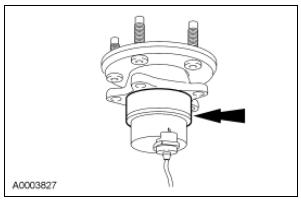
   - To install, tighten to 90 Nm (66 lb-ft).



7. ⚠ **CAUTION: The knuckle bore must be clean to allow the wheel hub and bearing to be completely seated by hand. Do not press or draw the wheel hub and bearing into place.**

   Clean and inspect the wheel knuckle bearing bore.

8. Lightly coat the surfaces of the bearing carrier and the wheel knuckle with anti-seize lubricant.



9. To install, reverse the removal procedure.

Wheel Studs

Special Tool(s)

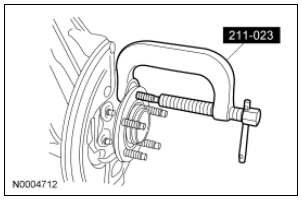
ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)

Removal

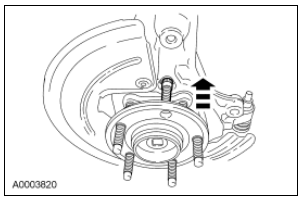
⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the front brake disc. For additional information, refer to Section 206-03 .

2. Using the special tool, press the stud from the flange.

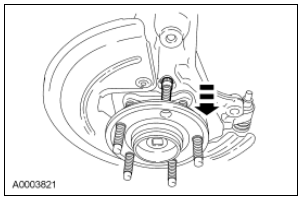


3. Line up the stud with the hole in the wheel knuckle and remove the stud.



Installation

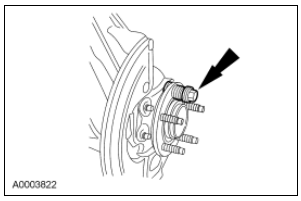
1. Insert the stud through the hole in the knuckle and into the flange, making sure the serrations on the stud line up with the serrations in the flange.



2. **⚠ CAUTION: Do not use power tools to install a wheel stud. The serrations in the flange can be stripped.**

   NOTE: Do not use the wheel nuts that came with the vehicle.

Install washers and a wheel nut on the wheel stud and tighten the nut until the stud seats against the flange. Discard the nut after use.



3. Install the front brake disc. For additional information, refer to Section 206-03 .

Lower Arm

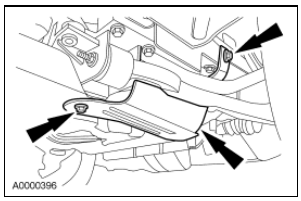
Removal

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: New cam bolts and lock nuts must be installed whenever the lower control arm is removed.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the shield.
   - Remove the shield bolts and a pushpin.



3. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   Remove and discard the stabilizer bar link lower nut. While prying down on the stabilizer bar, disconnect the stabilizer bar link.

4. Remove and discard the shock absorber lower nut and bolt. Disconnect the shock absorber and spring assembly from the lower arm.

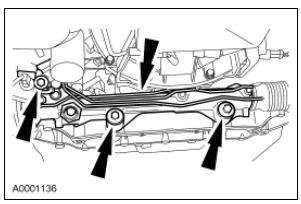
5. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   NOTE: The tapered washer is reused with the new ball joint nut.

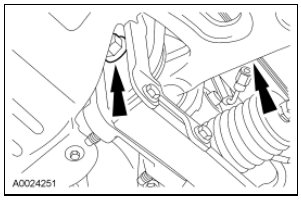
   Remove and discard the lower ball joint nut. Separate the front lower arm from the wheel knuckle.

6. Remove and discard the lower arm forward nut and bolt.

7. Remove the power steering gear nuts and bolts. Discard the nuts.
   - Position the power steering gear to access the lower control arm rearward bolt.



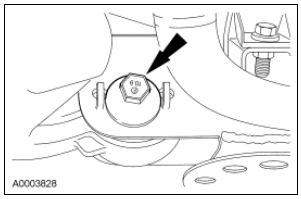
8. Remove and discard the lower control arm rearward nut and bolt. Remove the lower arm.



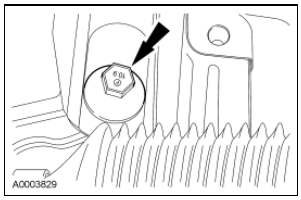
Installation

1. Position the lower arm.

2. Install a new caster adjustment cam bolt and a new nut.
   - The bolt must be installed from the rear, as shown.
   - Install the bolt with the cam lobe down.
   - The cam must be seated between the cam guides on the No. 1 crossmember.
   - The nut should only be hand-tightened at this time to allow for wheel alignment adjustment.
   - Final tighten the nut to 175 Nm (129 lb-ft).



3. Install a new camber adjustment cam bolt and a new nut.
   - The bolt must be installed from the rear as shown.
   - Install the bolt with the cam lobe down.
   - The cam must be seated in the groove in the No. 2 crossmember.
   - The nut should only be hand-tightened at this time to allow for wheel alignment adjustment.
   - Final tighten the nut to 175 Nm (129 lb-ft).



4. **NOTE:** Make sure the tapered washer is installed on the ball joint before connecting the lower control arm to the knuckle.

   NOTE: The hex-holding feature can be used to prevent turning of the stud while tightening the nut.

   Connect the lower control arm to the knuckle. Install a new lower ball joint nut.

   - Tighten to 200 Nm (148 lb-ft).

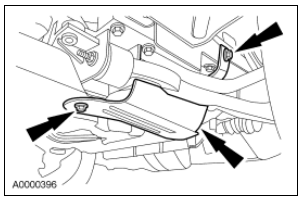
5. **NOTE:** Make sure the shock absorber lower bushing end caps are in place before installing the bolt and nut.

   Connect the shock absorber and spring assembly to the lower control arm. Install a new shock absorber lower bolt and nut.

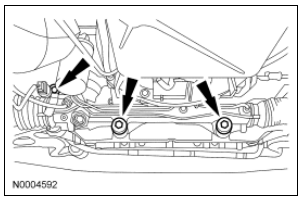
   - Tighten to 175 Nm (129 lb-ft).

6. While prying down on the stabilizer bar, connect the stabilizer bar link to the stabilizer bar. Install a new stabilizer bar link lower nut.
    - Install the nut until snug using the hex-holding feature, then tighten the nut using a socket and a torque wrench.
    - Tighten to 55 Nm (41 lb-ft).

7. Install the shield.
    - Install the shield bolts and a pushpin.



8. Position the power steering gear in place.
    - Install the power steering gear bolts and new nuts.
    - Tighten to 90 Nm (66 lb-ft).



9. Lower the vehicle.

10. Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Upper Arm

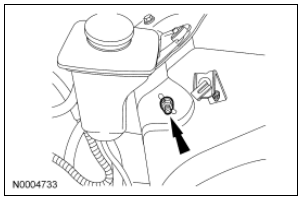
All vehicles

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

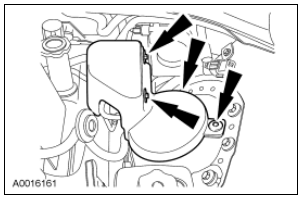
1. With the vehicle in NEUTRAL position it on a hoist. For additional information, refer to Section 100-02 .

LH upper arm

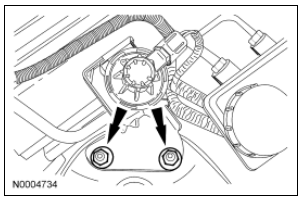
2. Remove and discard the power steering reservoir nut. Position the power steering reservoir aside.



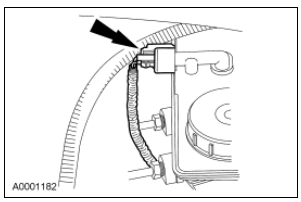
3. Remove the retainers and the LH upper shock mount cover, if equipped.



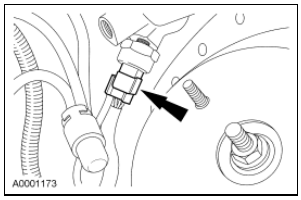
4. Remove the EVAP canister purge valve nuts and position the EVAP canister purge valve aside.
   - To install, tighten to 28 Nm (21 lb-ft).



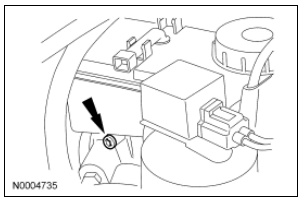
5. Disconnect the fluid level sensor connector.



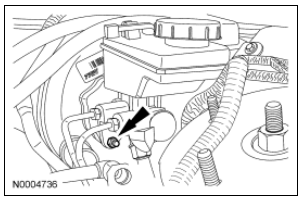
6. Disconnect the brake master cylinder main pressure transducer electrical connector, if equipped.



7. Back out the reservoir bolt to obtain access to the master cylinder bolt.
    - To install, tighten to 8 Nm (71 lb-in).

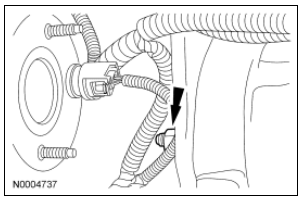


8. Remove the 2 brake master cylinder nuts and position the brake master cylinder aside.
    - To install, tighten to 25 Nm (18 lb-ft).



All vehicles

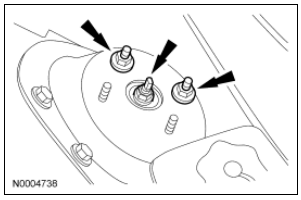
9. Remove and discard the upper arm-to-body nuts.
    - To install, tighten to 48 Nm (35 lb-ft).



10. ⚠ **WARNING: Do not remove the center nut. This nut holds the upper spring mount in place and if this nut is removed the spring tension will be released. Failure to follow these instructions may result in personal injury.**

    Remove and discard 2 shock absorber upper mount nuts.

    - To install, tighten to 28 Nm (21 lb-ft).

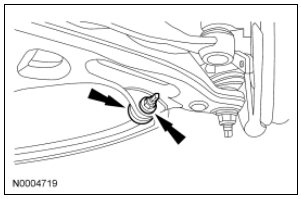


11. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

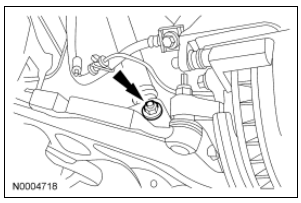
    Remove the stabilizer bar link lower nut. While prying down on the stabilizer bar, disconnect the

stabilizer bar link from the stabilizer bar.

- To install, tighten to 55 Nm (41 lb-ft).



12. Remove and discard shock absorber lower nut and bolt, then remove the shock absorber and spring assembly.
    - To install, tighten to 175 Nm (129 lb-ft).



13. **NOTE:** Support the top of the wheel knuckle to the body, using mechanic's wire or other suitable holding device, to prevent knuckle movement.

    NOTE: Use the hex-holding feature to prevent the upper control arm ball joint from turning while removing the nut.

    NOTE: The tapered washer on the ball joint is reused with the new nut.

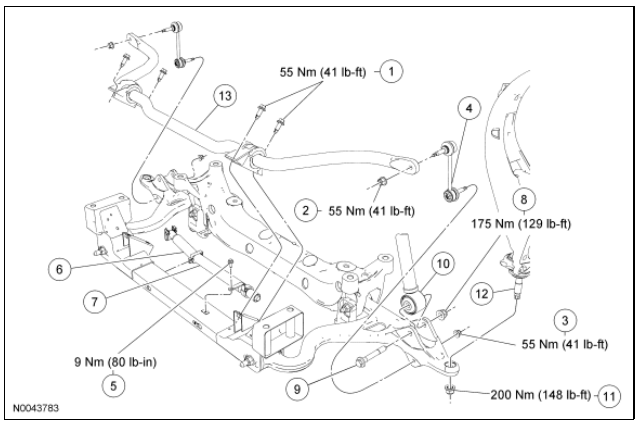
    Remove and discard the upper ball joint nut. Disconnect the upper arm from the knuckle.

    - To install, tighten to 90 Nm (66 lb-ft).

14. Remove and discard the upper arm-to-body bolts and remove the upper arm.

15. To install, reverse the removal procedure.

Stabilizer Bar



Item	Part Number	Description
1	W705551	Stabilizer bar bracket bolts
2	W520213	Stabilizer bar link upper nut
3	W520213	Stabilizer bar link lower nut
4	5K483	Stabilizer bar link
5	W705968	Air conditioning line bracket bolt
6	19D850	Air conditioning line retainer
7	19B632	Air conditioning line
8	W520215	Shock absorber lower nut
9	W705552	Shock absorber lower bolt
10	18124	LH shock absorber
11	W708553	LH lower ball joint lower nut
12	—	LH lower ball joint (part of 3K185)
13	5482	Stabilizer bar and bushing assembly

Removal and Installation

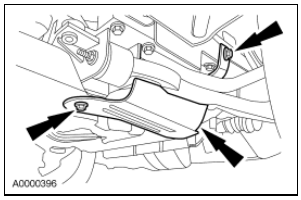
⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

⚠ CAUTION: Make sure that the stabilizer bar and brackets do not make contact with the radiator or damage to the radiator can occur.

1. Remove the engine cooling fan. For additional information, refer to Section 303-12 .

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the front and left side deflector shields.



4. Remove the 4 stabilizer bar bracket bolts.
    - To install, tighten to 55 Nm (41 lb-ft).
5. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   Remove and discard the stabilizer bar link upper nuts.

    - To install, tighten to 55 Nm (41 lb-ft).
6. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   Remove and discard the stabilizer bar link lower nuts, then disconnect the stabilizer bar links.

    - To install, tighten to 55 Nm (41 lb-ft).
7. Remove the air conditioning line bracket bolt.
    - To install, tighten to 9 Nm (80 lb-in).
8. Disconnect the air conditioning line retainer.
9. Remove the air conditioning line. For additional information, refer to Section 412-01 .
10. Remove and discard the LH shock absorber lower nut and bolt. Disconnect the LH shock absorber and spring assembly.
    - To install, tighten to 175 Nm (129 lb-ft).
11. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

    NOTE: The tapered washer on the ball joint is reused with the new nut.

    Remove and discard the LH lower ball joint nut. Disconnect the LH suspension lower arm.

    - To install, tighten to 200 Nm (148 lb-ft).
12. **NOTE:** Position the LH lower control arm downward to ease removal of the stabilizer bar.

    Carefully remove the stabilizer bar through the LH wheel well.
13. To install, reverse the removal procedure.

Stabilizer Bar Link

Removal

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: The stabilizer bar nuts are of a torque prevailing design. New nuts must be installed during assembly.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   Remove and discard the stabilizer bar link lower nut, then disconnect the stabilizer bar link from the lower arm.

   - To install, tighten to 55 Nm (41 lb-ft).

3. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   Remove and discard the stabilizer bar link upper nut, then remove the stabilizer bar link.

   - To install, tighten to 55 Nm (41 lb-ft).

4. To install, reverse the removal procedure.

Wheel Knuckle

Removal and Installation

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel bearing and hub. For additional information, refer to Wheel Bearing and Wheel Hub in this section.

2. **NOTE:** The hex-holding feature can be used to prevent the stud from turning while removing the nut.

   Remove and discard the tie-rod end nut and disconnect the tie-rod end from the wheel knuckle.

   - To install, tighten to 80 Nm (59 lb-ft).

3. **⚠ CAUTION: Using a suitable jack stand, support the weight of the knuckle after disconnecting the lower control arm, or damage to the upper control arm can result.**

   NOTE: The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   NOTE: The tapered washer on the ball joint is reused with the new nut.

   Remove and discard the lower ball joint nut, then disconnect the lower arm from the knuckle.

   - To install, tighten to 200 Nm (148 lb-ft).

4. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   NOTE: The tapered washer on the ball joint is reused with the new nut.

   Remove and discard the upper ball joint nut, then remove the knuckle.

   - To install, tighten to 90 Nm (66 lb-ft).

5. **⚠ CAUTION: Using a suitable jack stand, support the weight of the knuckle while connecting the knuckle to the upper control arm, or damage to the upper control arm can result.**

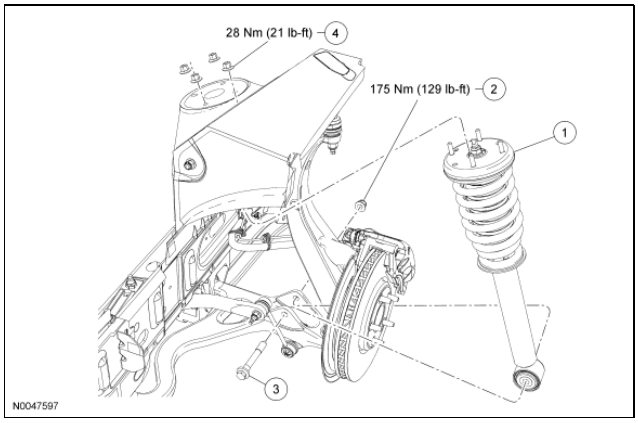
   NOTE: The upper ball joint nut, lower ball joint nut and the tie-rod end nut are of a torque prevailing design. New nuts must be installed.

   NOTE: Make sure the tapered washer is installed on the ball joints before connecting the upper and lower control arms to the knuckle.

   To install, reverse the removal procedure.

Shock Absorber and Spring Assembly

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	—	Shock absorber and spring assembly
2	W520215	Shock absorber lower nut
3	W705552	Shock absorber lower bolt
4	W705956	Rivet (3 required)
5	W704790	Shock absorber upper mount nut (4 required)
6	3C239 RH/ 3C240 LH	LH shock mount cover

Removal and Installation

⚠ **CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. ⚠ **WARNING: Do not remove the center nut. This nut holds the upper spring mount in place and if this nut is removed the spring tension will be released. Failure to follow these instructions may result in personal injury.**

   Remove and discard the shock absorber upper mount nuts.

   - To install, tighten to 28 Nm (21 lb-ft).

3. **NOTE:** The hex-holding feature can be used to prevent turning of the stud while removing the nut.

   Remove and discard the stabilizer bar link lower nut, then disconnect the stabilizer bar link from the lower arm.

   - To install, tighten to 55 Nm (41 lb-ft).

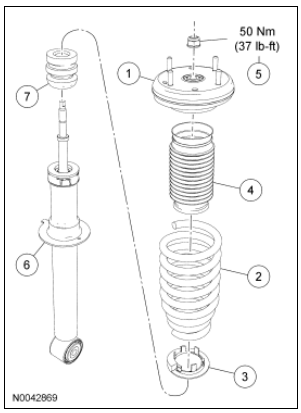
4. Remove and discard the shock absorber lower nut and bolt, then remove the shock absorber and spring assembly.
    - To install, tighten to 175 Nm (129 lb-ft).

5. For additional information on the disassembly and assembly of the shock absorber and spring assembly, refer to Shock Absorber and Spring Assembly in this section.

6. ⚠ **CAUTION: Make sure the shock absorber lower bushing end caps are in place before installing the bolt and nut.**

   To install, reverse the removal procedure.

Shock Absorber and Spring Assembly



Item	Part Number	Description
1	18183	Shock absorber upper mount
2	5310	Spring
3	—	Spring lower seat (part of 18124)
4	—	Dust boot (part of 18183)
5	W704792	Shock absorber rod nut
6	18124	Shock absorber
7	—	Jounce bumper (part of 18124)

⚠ WARNING: All vehicles are equipped with gas pressurized shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component servicing. Failure to follow these instructions may result in personal injury.

⚠ WARNING: The shock absorber and spring assembly is under extreme load. Do not attempt to disassemble the shock absorber and spring assembly without using a spring compressor. Failure to follow these instructions may result in personal injury.

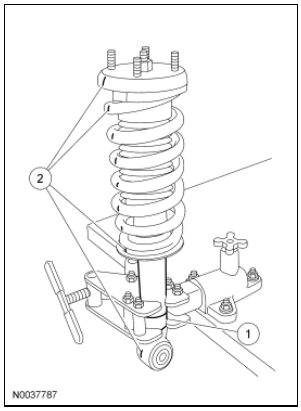
⚠ CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the shock absorber and spring assembly. For additional information, refer to Shock Absorber and Spring Assembly in this section.

2. **⚠ CAUTION: Over-tightening the vise can damage the shock absorber tube.**

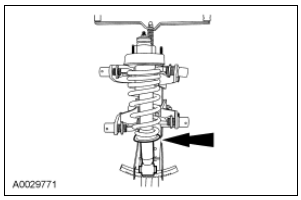
   Mount and mark the shock absorber and spring assembly.

   1. Position the shock absorber and spring assembly in a suitable holding device.
   2. Mark the upper mount, spring and shock absorber for assembly reference.

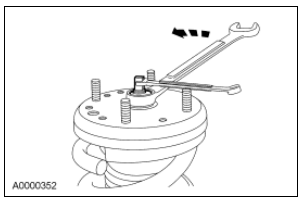


3. **NOTE:** If installing a new spring, make sure the part number is correct. Refer to the vehicle certification (VC) label for the correct spring code. Refer to Section 100-01 to convert the spring code to a part number.

   Using a suitable spring compressor, compress the spring until the tension is released from the shock absorber.



4. While holding the shock absorber rod, remove and discard the nut.
   - To install, tighten to 50 Nm (37 lb-ft).



5. Remove the upper mount and dust boot as an assembly.

6. Carefully remove the spring and spring compressor.

7. To assemble, reverse the disassembly procedure.

General Specifications

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (in Canada CXC-51-A)	—

Torque Specifications

Description	Nm	lb-ft	lb-in
Rear Suspension			
Subframe-to-body bolts	103	76	—
Upper arm-to-subframe nuts	90	66	—
Upper ball joint nut	90	66	—
Lower arm-to-subframe rearward bolt	175	129	—
Lower arm-to-subframe forward nut	180	133	—
Lower arm-to-wheel knuckle nut	150	111	—
Toe link outboard nut	55	41	—
Toe link inboard nut	70	52	—
Stabilizer bar link nuts	48	35	—
Stabilizer bar bracket bolts	55	41	—
Wheel speed sensor bolt	8	—	71
Shock absorber lower bolt	133	98	—
Shock absorber rod nut	50	37	—
Shock absorber upper mount nuts	28	21	—
Axle shaft nut	410	303	—

Rear Suspension

⚠ WARNING: All vehicles are equipped with gas-pressurized shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component servicing. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Suspension fasteners are critical parts because they can affect the performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during assembly to make sure of correct retention of these parts. Never attempt to heat, quench or straighten any rear suspension part. Install a new part.

NOTE: The rear wheel knuckle and wheel hub is serviced as an assembly. The components are not serviced individually.

Only the toe is adjustable on the rear suspension system. The rear toe is adjusted by the use of toe link assemblies connecting the knuckles to the rear subframe.

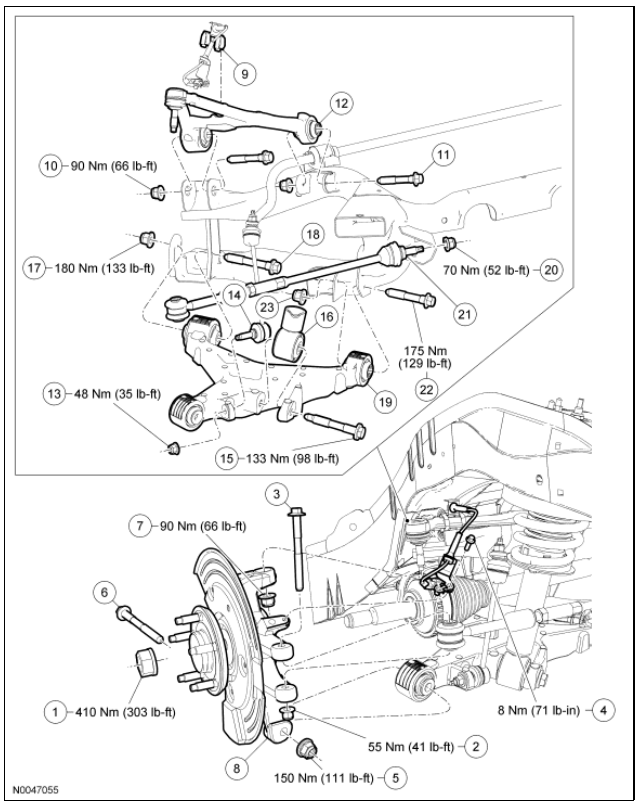
The independent rear suspension consists of the following components:

- Rear upper suspension arm and bushing
- Rear lower suspension arm and bushing
- Rear shock absorber and spring assembly
- Rear stabilizer bar
- Rear stabilizer bar bushings
- Rear stabilizer bar brackets
- Rear stabilizer bar links
- Rear wheel knuckle/wheel hub assembly
- Rear wheel studs
- Rear toe link

Rear Suspension

Refer to Section 204-00 .

Rear Suspension — Exploded View



Item	Part Number	Description
1	4B477	Axle shaft nut
2	W520213	Toe link outboard nut
3	W705517	Toe link outboard bolt
4	W500014	Wheel speed sensor bolt
5	W705518	Lower arm-to-wheel knuckle nut
6	W705516	Lower arm-to-wheel knuckle bolt
7	W520214	Upper ball joint nut
8	5A968	Wheel knuckle and wheel hub assembly
9	—	Speed sensor retainer clip (part of 2C190)
10	W520214	Upper arm-to-subframe nut (2 required)
11	W704887	Upper arm-to-subframe bolt (2 required)
12	5500	Upper arm
13	W520213	Stabilizer bar link lower nut
14	5C486	Stabilizer bar link
15	W704884	Shock absorber lower bolt
16	18125	Shock absorber
17	W520215	Lower arm-to-subframe forward nut
18	W704886/ 704888	Lower arm-to-subframe forward bolt
19	5A649	Lower arm

20	N807144	Toe link inboard nut
21	5B551	Toe link
22	W704886	Lower arm-to-subframe rearward bolt
23	W520215	Lower arm-to-subframe rearward nut

1. For additional information, refer to the procedures in this section.

Wheel Studs

Special Tool(s)

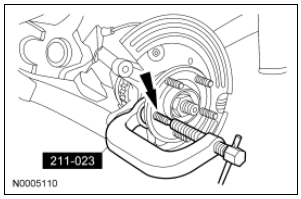
ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the rear brake disc. For additional information, refer to Section 206-04 .
3. **NOTE:** If necessary, cut off one inch of the stud to ease removal.

   Using the special tool, press the wheel stud out of the rear hub between the caliper mounting pads.

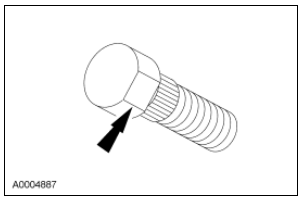
   - Discard the wheel stud. Do not reuse wheel studs.



Installation

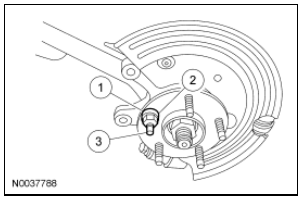
⚠ **CAUTION: Never use air tools to install wheel studs. The serrations can be stripped from the stud.**

1. If necessary, grind the head of a new wheel stud to a "D" shape to clear the wheel knuckle.



2. Position the new wheel stud into the hub flange, making sure the serrations on the stud are aligned with the serrations in the flange.
3. Install the wheel stud.
   1. Place 4 flat washers on the wheel stud.
   2. **NOTE:** Do not use the wheel nuts that came with the vehicle.

      Thread a standard wheel nut onto the wheel stud with the flat side against the washers.
   3. Tighten the wheel nut until the wheel stud head seats against the hub flange.



4. Remove the wheel nut and washers.

5. Install the rear brake disc. For additional information, refer to Section 206-04 .

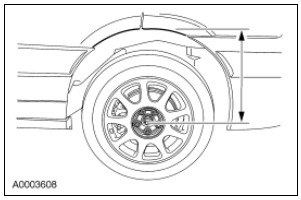
Upper Arm

Removal

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

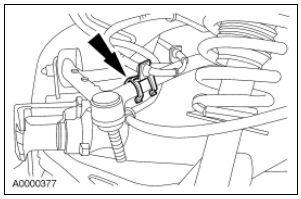
NOTE: The suspension upper arm bushings or ball joints are not serviced separately from the upper rear suspension arm. If the bushings or ball joints require service a new suspension upper arm must be installed.

1. Remove the hub cap. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position.

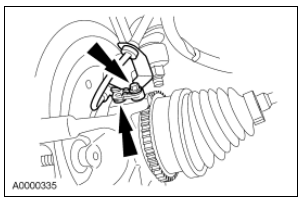


2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Unclip the wheel speed sensor wire retainer from the suspension upper arm.



4. Remove the wheel speed sensor bolt and the wheel speed sensor. Position the sensor aside.



5. **⚠ CAUTION: Use care not to damage the wheel speed sensor tone ring. A damaged sensor ring will result in incorrect ABS operation.**

   NOTE: Use the hex-holding feature to prevent the ball joint from turning while removing the nut.

   Remove and discard the upper ball joint nut, then disconnect the upper ball joint from the wheel knuckle.

6. Remove and discard the upper arm-to-subframe nuts and bolts and remove the upper arm.

Installation

⚠ CAUTION: Do not tighten the suspension upper arm-to-subframe nuts until the suspension is at curb height. Failure to do so can cause severe damage to the bushings resulting in poor ride quality and handling.

1. **NOTE:** The upper arm-to-subframe bolts and nuts are of a torque prevailing design. New bolts and nuts must be used.

   Position the arm on the subframe and install new suspension upper arm-to-subframe nuts and bolts. Do not tighten at this time.

2. **⚠ CAUTION: Use care not to damage the wheel speed sensor tone ring. A damaged sensor ring will result in incorrect ABS operation.**

   NOTE: Install the ball joint nut using the hex-holding feature until snug. Final tighten the nut using a line-type crow's foot and a torque wrench.

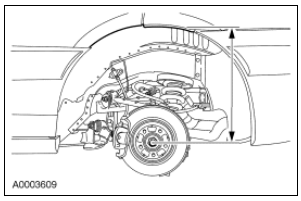
   Connect the ball joint to the wheel knuckle and hub assembly. Install a new ball joint nut.

   - Tighten to 90 Nm (66 lb-ft).

3. Clip the wheel speed sensor wire to the suspension upper arm.

4. Position the wheel speed sensor and install the bolt.
   - Tighten to 8 Nm (71 lb-in).

5. Position a jack stand under the suspension lower arm and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Removal, Step 1.



6. Tighten the upper arm-to-subframe nuts.
   - Tighten to 90 Nm (66 lb-ft).

7. Lower the suspension and remove the jack stand.

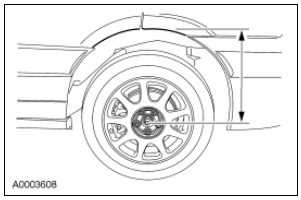
Lower Arm

Removal

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: The lower arm bushings are not serviced separately from the lower suspension arm. If the bushings require service, a new lower arm must be installed.

1. With the vehicle in a static, level ground position, remove the hub cap and measure the distance from the center of the hub to the lip of the fender (curb height).



2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the rear brake disc. For additional information, refer to Section 206-04 .

4. Remove and discard the shock absorber lower bolt and disconnect the shock absorber and spring assembly from the lower arm.

5. **⚠ CAUTION: Do not use air tools to remove the nut. Damage to the boot can result.**

   NOTE: Use the hex-holding feature to prevent the stabilizer bar link ball joint from turning while removing the stabilizer bar link nut.

   Remove and discard the stabilizer bar link lower nut and disconnect the stabilizer bar link.

6. Remove and discard the lower arm-to-wheel knuckle bolt and disconnect the lower arm.

7. Remove and discard the lower arm-to-subframe bolts and remove the lower arm.

Installation

⚠ CAUTION: Do not tighten the lower arm-to-subframe fasteners until the suspension is at curb height. Failure to do so can cause severe damage to the bushings resulting in poor ride quality and handling.

1. Position the lower arm onto the subframe and install new lower arm-to-subframe bolts and nuts. Do not tighten at this time.

2. Connect the lower arm to the wheel knuckle. Install a new lower arm-to-wheel knuckle nut and bolt.

- Tighten to 150 Nm (111 lb-ft).

3. ⚠ **CAUTION: Do not use air tools to install the nut. Damage to the boot can result.**

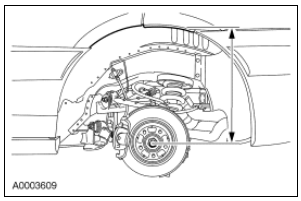
   NOTE: Use the hex-holding feature to prevent the stabilizer bar link ball joint from turning while installing the nut on the stabilizer bar link. Tighten the nut to specification using a socket and a torque wrench.

   Connect the stabilizer bar link to the lower arm. Install a new stabilizer bar link lower nut.

   - Tighten to 48 Nm (35 lb-ft).

4. Position the shock absorber and spring assembly onto the lower arm. Install a new shock absorber lower bolt.
   - Tighten to 133 Nm (98 lb-ft).

5. Position a jack stand under the lower arm and raise the suspension until the measurement between the center of the hub and the lip of the fender is equal to the measurement taken in Removal, Step 1 (curb height).



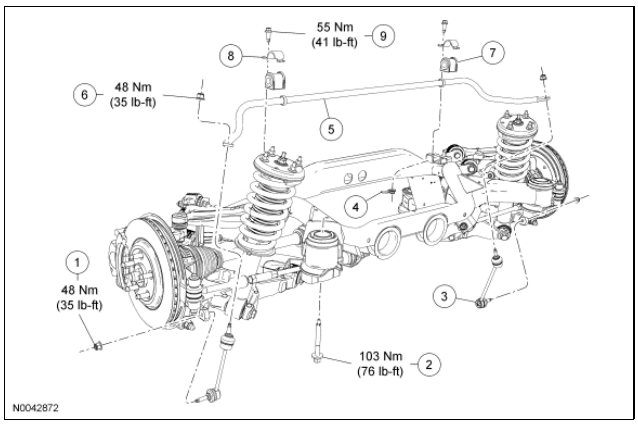
6. Tighten the lower arm-to-subframe rearward bolt.
   - Tighten to 175 Nm (129 lb-ft).

7. Tighten the lower arm-to-subframe forward nut.
   - Tighten to 180 Nm (133 lb-ft).

8. Lower the suspension and remove the jack stand.

9. Install the rear brake disc. For additional information, refer to Section 206-04 .

Stabilizer Bar

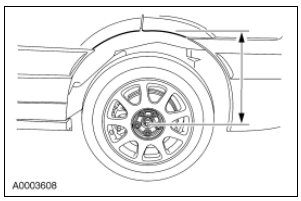


Item	Part Number	Description
1	W520213	Stabilizer bar link lower nut (2 required)
2	W706614	Subframe-to-body bolt (4 required)
3	5C486	Stabilizer bar link (2 required)
4	W704834	Stabilizer bar bracket flag nut (2 required)
5	5A772	Stabilizer bar
6	W520213	Stabilizer bar link upper nut (2 required)
7	5493	Stabilizer bar bushing (2 required)
8	5486	Stabilizer bar bracket (2 required)
9	W705551	Stabilizer bar bracket bolt (2 required)

Removal

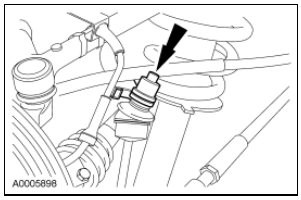
⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the hub cap and measure the distance from the center of the wheel hub to the lip of the fender with the vehicle in a static, level ground position (curb height).



2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. If equipped, remove the cap from the stabilizer link.

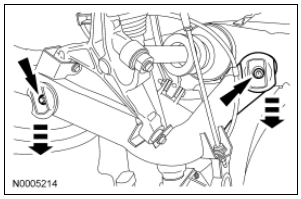


4. ⚠ **CAUTION: Do not use air tools to remove the nut. Damage to the boot can occur.**

   NOTE: Use the hex-holding feature to prevent the stabilizer bar link ball joint ball studs from turning when removing the stabilizer bar link nuts.

   Remove and discard the stabilizer bar link upper nuts and disconnect the stabilizer bar links from the bar.

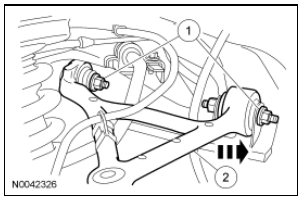
5. Using suitable jack stands, support the subframe. Remove the subframe forward bolts and lower the front of the subframe approximately 37 mm (1.48 in).



6. Remove the stabilizer bar bracket bolts, flag nuts and brackets.

7. Remove the stabilizer bar bushings.

8. Remove and discard the upper arm-to-subframe nuts and bolts. Disconnect the upper arms and rotate them aside.



9. **NOTE:** The stabilizer bar can be removed from either side.

   Remove the stabilizer bar.

Installation

1. **NOTE:** The stabilizer bar can be installed from either side.

   Position the stabilizer bar in the vehicle.

2. **NOTE:** If the stabilizer bar bushings are badly worn or damaged, install new bushings. Do not apply grease or petroleum-based lubricants to the stabilizer bar bushing.

   Install the stabilizer bar bushings.

3. Position the stabilizer bar brackets and install the stabilizer bar bracket flag nuts and bolts.
   - Tighten to 55 Nm (41 lb-ft).

4. ⚠ **CAUTION: The upper arm must be at curb height before the nuts can be tightened. Failure to do so will result in damage to the bushings resulting in poor ride quality and handling.**

   Position the arm on the subframe and install new upper arm bolts and nuts. Do not tighten the nuts at this time.

5. ⚠ **CAUTION: Do not use air tools to install the nut. Damage to the boot can occur.**

   NOTE: The nuts retaining the stabilizer bar link are of a torque prevailing design and new nuts must be used during installation of the stabilizer bar link.

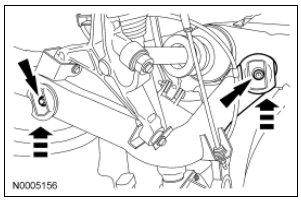
   NOTE: Use the hex-holding feature to prevent the stabilizer bar link ball studs from turning when installing the stabilizer bar link ball stud nuts. Tighten the nut to specification using a socket and a torque wrench.

   Connect the stabilizer bar links to the stabilizer bar and install new stabilizer bar link upper nuts.

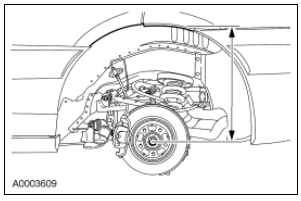
   - Tighten to 48 Nm (35 lb-ft).

6. If removed, install the protective cap on the stabilizer bar link.

7. Raise the subframe and install the subframe-to-body bolts.
   - Tighten to 103 Nm (76 lb-ft).



8. Position jack stands under the suspension lower arm and bushings and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken during Removal, Step 1 (curb height).



9. Tighten the upper arm-to-subframe nuts.
   - Tighten to 90 Nm (66 lb-ft).

Stabilizer Bar Link

Removal and Installation

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: The nuts retaining the stabilizer bar link are of a torque prevailing design and new nuts must be used during installation of the stabilizer bar link.

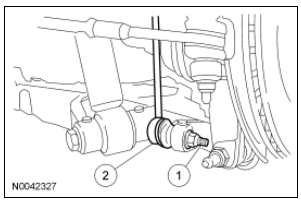
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **⚠ CAUTION: Do not use air tools to remove the nut. Damage to the boot can occur.**

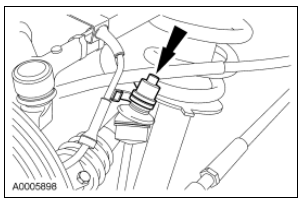
   NOTE: Use the hex-holding feature to prevent the stabilizer bar link ball joint from turning while removing the stabilizer bar link nut.

   Remove and discard the stabilizer bar link lower nut and disconnect the stabilizer bar link from the lower arm.

   - To install, tighten to 48 Nm (35 lb-ft).



3. If equipped, remove the protective cap from the stabilizer bar link.



4. **⚠ CAUTION: Do not use air tools to remove the nut. Damage to the boot can occur.**

   NOTE: Use the hex-holding feature to prevent the stabilizer bar link ball joint from turning while removing the stabilizer bar link nut.

   Remove the stabilizer bar link upper nut and the stabilizer bar link. Discard the stabilizer bar link nut.

   - To install, tighten to 48 Nm (35 lb-ft).

5. To install, reverse the removal procedure.

Toe Link

Removal

⚠ CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: The toe link retainers are of a torque prevailing design and new bolts and nuts must be used during installation.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove and discard the toe link outboard nut and bolt and disconnect the toe link from the wheel knuckle.
   - To install, tighten to 55 Nm (41 lb-ft)

3. **NOTE:** Use the hex-holding feature to prevent the toe link ball joint from turning while removing the nut.

   Remove and discard the toe link inboard nut and remove the toe link.

   - To install, tighten to 70 Nm (52 lb-ft)

4. To install, reverse the removal procedure.

5. Check and, if necessary, align the rear end. For additional information, refer to Section 204-00 .

Stabilizer Bar Bushing

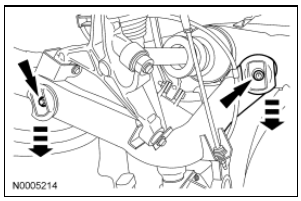
Removal and Installation

⚠ CAUTION: Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: Do not apply grease or petroleum-based lubricants to the stabilizer bar bushings.

1. With the vehicle in NEUTRAL, position it on a hoist.

2. Using suitable jack stands, support the subframe. Remove the subframe forward bolts and lower the front of the subframe approximately 37 mm (1.48 in).
   - To install, tighten to 90 Nm (66 lb-ft).



3. Remove the stabilizer bar bracket flag nuts, bolts and brackets.
   - To install, tighten to 55 Nm (41 lb-ft).

4. Remove the stabilizer bar bushing(s).

5. To install, reverse the removal procedure.

Wheel Knuckle

Special Tool(s)

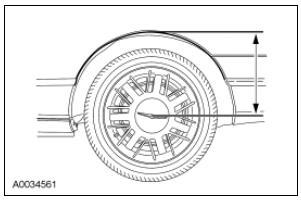
ST1516-A	Remover/Installer, Front Wheel Hub 204-069 (T81P-1104-C)
ST1517-A	Adapter, Wheel Hub 205-237 (T86P-1104-A1)
ST1518-A	Remover, Wheel Stud (Metric) 204-085 (T83P-1104-BH)

Removal

⚠ CAUTION: Suspension fasteners are important parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

⚠ CAUTION: The wheel knuckle/wheel hub is serviced as an assembly. Do not attempt to separate the wheel hub from the wheel knuckle.

1. For reference during the installation of an upper or lower arm, measure the distance between the center of the wheel hub and the lip of the fender with the weight of the vehicle resting on the wheel and tire assemblies.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2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the rear brake disc. For additional information, refer to Section 206-04 .

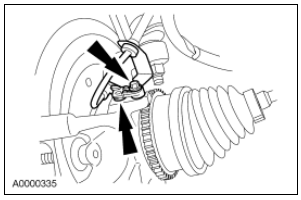
4. **⚠ CAUTION: The axle shaft retaining nut is a one time use item and a new nut must be installed when removed. Failure to do so can cause the nut to loosen during vehicle operation resulting in loss of vehicle control.**

   Remove and discard the axle shaft nut.

   - To install, tighten to 410 Nm (303 lb-ft).

5. Remove and discard the toe link outboard nut and bolt and disconnect the toe link from the wheel knuckle.
    - To install, tighten to 55 Nm (41 lb-ft).

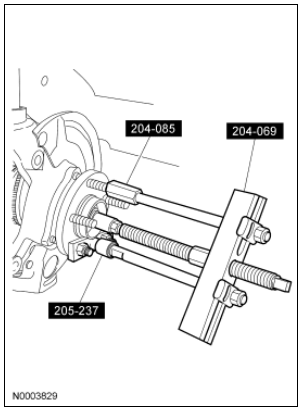
6. Remove the wheel speed sensor bolt and disconnect the wheel speed sensor.
    - To install, tighten to 8 Nm (71 lb-in).



7. **⚠ CAUTION: Support the axle shaft after removing it from the hub. Failure to do so can damage the axle shaft.**

   ⚠ CAUTION: Do not use a hammer to separate the outboard CV joint from the hub. Damage to the threads and internal CV joint components can result.

   Using the special tools, separate the axle shaft from the hub. Support the axle shaft.



8. Remove and discard the lower arm-to-knuckle nut and bolt, then disconnect the lower arm from the knuckle.
    - To install, tighten to 150 Nm (111 lb-ft).

9. **NOTE:** Use the hex-holding feature to prevent the upper arm ball joint from turning while removing the nut.

   Remove and discard the upper ball joint nut and disconnect the upper arm from the knuckle.

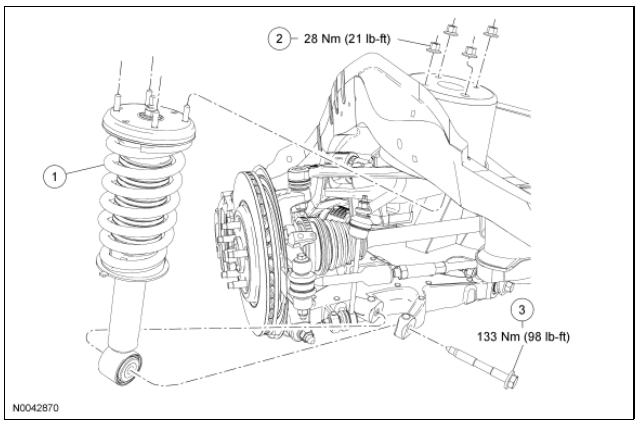
    - To install, tighten to 90 Nm (66 lb-ft)

10. Before tightening the upper or lower suspension arm-to-frame fasteners, position a jack under the lower arm and raise the vehicle until the distance between the center of the hub and the lip of fender is equal to the measurement taken during Step 1 of the removal procedure.

11. To install, reverse the removal procedure.

12. Check and, if necessary, align the rear end. For additional information, refer to Section 204-00 .

Shock Absorber and Spring Assembly



Item	Part Number	Description
1	—	Shock absorber and spring assembly
2	W704790	Shock absorber upper mount nut (3 required)
3	W704884	Shock absorber lower bolt

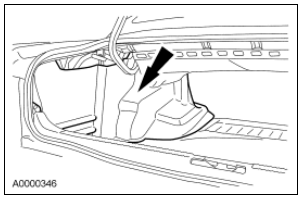
Removal and Installation

⚠ WARNING: All vehicles are equipped with gas-pressurized rear shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component service. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Open the luggage compartment lid.

2. Position the trim cover aside.



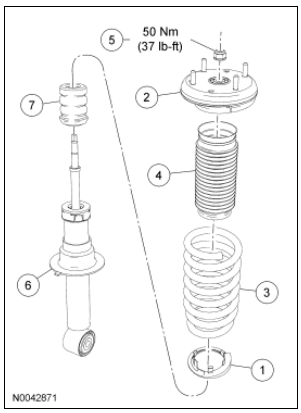
3. Remove and discard the shock absorber upper mount nuts.
   - To install, tighten to 28 Nm (21 lb-ft).

4. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

5. Remove and discard the shock absorber lower bolt.
   - To install, tighten to 133 Nm (98 lb-ft).

6. To install, reverse the removal procedure.

Shock Absorber and Spring Assembly



Item	Part Number	Description
1	—	Spring lower seat (part of 18125)
2	18197	Shock absorber upper mount
3	5560	Spring
4	—	Dust boot (part of 18197)
5	W704792	Shock absorber rod nut
6	18125	Shock absorber
7	—	Jounce bumper (part of 18125)

⚠ WARNING: All vehicles are equipped with gas-pressurized rear shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component service. Failure to follow these instructions may result in personal injury.

⚠ WARNING: The shock absorber and spring assembly is under extreme load. Do not attempt to disassemble the shock absorber and spring assembly without using a spring compressor. Failure to follow these instructions may result in personal injury.

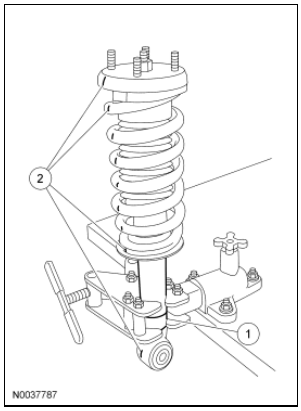
⚠ CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the shock absorber and spring assembly. For additional information, refer to Shock Absorber and Spring Assembly in this section.

2. **⚠ CAUTION: Overtightening the vise can damage the shock absorber tube.**

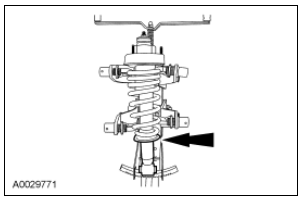
   Mount and mark the shock absorber and spring assembly.

   1. Position the shock absorber and spring assembly in a suitable holding device.
   2. Mark the upper mount, spring and shock absorber for assembly reference

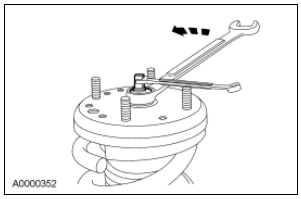


3. **NOTE:** If installing a new spring, make sure the part number is correct. Refer to the vehicle certification (VC) label for the correct spring code. For additional information, refer to Section 100-01 to convert the spring code to a part number.

   Using a suitable spring compressor, compress the spring until the tension is released from the shock absorber.



4. While holding the shock absorber rod, remove the nut.
   - To install, tighten to 50 Nm (37 lb-ft).



5. Remove the upper mount and dust boot as an assembly.

6. Carefully remove the spring and spring compressor.

7. To assemble, reverse the disassembly procedure.

General Specifications

Item	Specification
Wheel stud and wheel nuts (metric)	M12 x 1.5-19 mm hex
Wheel bolt circle runout	0.65 mm (0.02 in)
Tire Inflation	
Tires	See safety certification sticker located on driver door jamb or tire inflation placard on the passenger door jamb.
Tire Tread Depth	
P225/55R16 94V	8.74 mm (0.34 in)
P225/55R16 95W	8.38 mm (0.33 in)
P235/50R17 95V	7.7 mm (0.30 in)
P235/50R17 95W	7.52 mm (0.30 in)
Wheels	
Painted aluminum	16 x 7.5J
Chromed aluminum	16 x 7.5J
Bright polished aluminum	16 x 7.5J
Chromed Aluminum	17 x 7.5J
Bright machined aluminum	17 x 7.5J
Wheel offset	60 mm (2.4 in)
Wheel bolt circle runout	0.65 mm (0.02 in)
Cleaners — Wheel	
Custom Bright Metal Cleaner ZC-17C	ESR-M5B194-B

Wheel Rim Runout

Max. radial runout	Max. lateral runout
1.0 mm (0.04 in)	1.0 mm (0.04 in)

Tire Runout Specifications

Max. radial runout	Max. lateral runout

1.5 mm (0.06 in)	2 mm (0.08 in)

Torque Specifications

Description	Nm	lb-ft
Wheel nuts	135	100
Torque stick	gray	—

Safety Precautions

⚠ WARNING: Never run the engine with one wheel off the ground, for example, when changing a tire. The wheel(s) resting on the ground can cause the vehicle to move. Failure to follow these instructions may result in personal injury.

⚠ WARNING: The tire and wheel must always be correctly matched. It is very important to determine the size of each component before any assembly operations commence. Failure to adhere to these instructions can result in an explosive separation. Failure to follow these instructions may result inpersonal injury.

⚠ WARNING: Aftermarket aerosol tire sealants are extremely flammable. Always question the customer to make sure these products have not been used. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Aftermarket wheel assemblies may not be compatible with the vehicle. Use of incompatible wheel assemblies can result in equipment failure. Use only approved wheel assemblies. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Use only wheels and wheel nuts that have been designed for current model year Ford vehicles. Aftermarket wheels or wheel nuts may not fit or function correctly. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Always wear safety goggles or a face shield when performing any work with tire and wheel assemblies. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Do not clean aluminum wheels with steel wool, abrasive-type cleaners or strong detergents. Use Custom Bright Metal Cleaner ZC-17C.

⚠ CAUTION: Reduce the air pressure as much as possible by pushing the valve core plunger in prior to removing the valve core. Avoid working in a position in which the face or body is directly over a tire in which there is pressure.

When carrying out any inspection or repair procedures on wheels and tires, follow the preceding safety precautions.

Wheels And Tires

⚠ WARNING: Do not mix different types of tires, such as radial, bias or bias-belted, on the same vehicle except in emergencies (temporary spare usage). Vehicle handling can be seriously affected and can result in loss of control. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: When removing adhesive stick-on weights from wheels, use a plastic scraper to prevent damaging the wheels' protective finish.

If the vehicle is equipped with uni-directional tires, mount the tires on the vehicle only in accordance with the manufacturer's instructions for direction of rotation printed on the side wall.

Original equipment uni-directional full-size spare tires can be operated with rotation counter to the directional arrow on the tire sidewall, but will perform best when rotating with the directional arrow on the sidewall.

Factory-installed tires and wheels are designed to operate satisfactorily with loads up to and including full-rated load capacity when inflated to recommended inflation pressures.

Wheels And Tires

Special Tool(s)

ST2869-A	Digital Tire Gauge 204-354
ST3058-A	Hunter Road Force® Wheel Balancer GSP9700 Series

Inspection and Verification

⚠ WARNING: Vehicle may have multiple drive wheels. Do not use engine to power the driveline unless all drive wheels are elevated off the ground. Drive wheels in contact with ground could cause unexpected vehicle movement. Failure to follow this instruction may result in serious personal injury.

Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are apparent, GO to Symptom Chart - Wheel and Tire Vibration .

To maximize tire performance, inspect for signs of incorrect inflation and uneven wear, which may indicate a need for balancing, rotation or front suspension alignment.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

Replacement tires must follow the recommended:

- tire sizes.
- speed rating.
- load range.
- tire construction type.

The use of any other tire/wheel size or type can seriously affect:

- ride.
- handling.
- speedometer/odometer calibration.
- vehicle ground clearance.
- tire clearance between the body and chassis.
- wheel bearing life.
- brake cooling.

New wheels need to be installed when the vehicle's wheels:

- are bent.
- are cracked.
- are dented.
- are heavily corroded.

- are leaking.
- have elongated wheel hub bolt holes.
- have excessive lateral or radial runout.

It is mandatory to use only the tire sizes recommended on the tire chart attached to the vehicle. Larger or smaller tires can damage the vehicle, affect durability and require changing the speedometer calibration. Make sure wheel size and offsets match those recommended for the tire in use.

1. Inspect the tires for signs of uneven wear. Refer to the following descriptions to identify the type of wear and GO to Symptom Chart - Tire Wear for the appropriate repair action to be carried out.

2. Check the tires for:
   - cuts.
   - stone bruises.
   - abrasions.
   - blisters.
   - embedded objects.

3. Tread wear indicators are molded into the bottom of the tread grooves. Install a new tire when the indicator bands are less than 2/32 in.

Tire Wear

Tire wear is commonly defined as a loss of tread depth. Tire tread wear occurs due to friction with the contact surface (road/pavement). The tread should wear down uniformly all the way around the circumference of the tire and all the way across the tread face. When this does not occur, the tire may have abnormal/incorrect wear.

Normal Tire Wear

Normal tire wear is identified as even wear around and across the tread. Because there are many factors (driving style, road surfaces, type of vehicle, type of tire) that can affect tire wear, there is no absolute mileage expectation for a normal wear condition. A tire is considered worn-out when the tread has worn to the level of the tread-wear indicators.

Abnormal/Incorrect Tire Wear

Abnormal/incorrect tire wear is identified as tire wear that is not even around or across the tread and that creates performance-related issues.

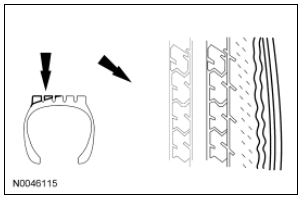
Abnormal/incorrect wear can be caused by numerous factors, some of which include driving style (aggressive, passive), climate (hot, cold), road conditions, vehicle loading and maintenance. It is important to determine the root cause of wear on a vehicle before carrying out repair. Tires exhibiting abnormal/incorrect tire wear may still be serviceable provided that the minimum tread depth is greater than 2/32 in and the tire is not causing a vehicle performance (noise/vibration) concern.

Some abnormal/incorrect wear patterns look the same all the way around the tread of the tire, other wear patterns are not consistent and can occur in various spots on the tread area. The underlying causes of the 6 wear categories are different. Refer to the following descriptions to identify the type of wear and GO to Symptom Chart - Tire Wear for the appropriate repair action to be carried out.

Inner Edge/Shoulder Wear

Inner edge (or shoulder) wear occurs on the inside edge of the tire and is usually caused by excessive toe out and/or excessive negative camber. If the tread depth of the outer shoulder is at least 50% greater than the tread depth of the inner shoulder, the tire is experiencing inner edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, the tread depth of each rib may need to be measured to compare it to that of the shoulder.

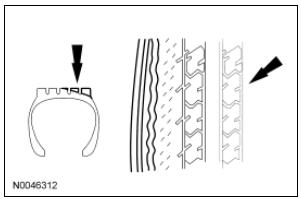
NOTE: RF tire shown, others similar.



Outer Edge/Shoulder Wear

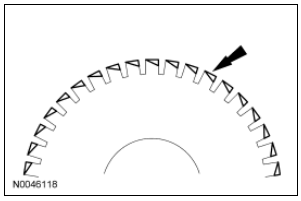
Outer edge (or shoulder) wear occurs on the outside edge of the tire and is usually caused by excessive toe in and/or excessive positive camber. If the tread depth of the inner shoulder is at least 50% greater than the tread depth of the outer shoulder, the tire is experiencing outer edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, the tread depth of each rib may need to be measured to compare it to that of the shoulder.

NOTE: RF tire shown, others similar.



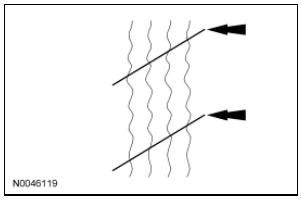
Heel/Toe Wear

Heel/toe wear (also known as feathering) occurs along the outside or inside edge/shoulder of the tire. To determine whether tires have this type of wear, visually inspect the tires in both the inside and outside shoulder ribs. In some instances, the difference in tread depth of leading versus trailing edge of each lug in the inside and outside shoulder rib may need to be measured.



Diagonal Wear

Diagonal wear occurs diagonally across the tread area and around the circumference of the tire. To determine whether tires have this type of wear, visually inspect the tires to determine if the wear pattern runs diagonally across the tread and around the circumference of the tire. In some instances, the difference in tread depth along the diagonal wear pattern may need to be measured.



Symptom Chart — Tire Wear

Symptom Chart — Tire Wear

Symptom Chart — Wheel and Tire Vibration

Symptom Chart — Wheel and Tire Vibration

Pinpoint Tests

For a description of the various tire wear patterns, refer to Inspection and Verification.

Pinpoint Test A: Inner Edge/Shoulder Wear

This pinpoint test is intended to diagnose the following:
- Excessive toe out
- Incorrect wheel and tire rotation

PINPOINT TEST A: INNER EDGE/SHOULDER WEAR

Test Step	Result / Action to Take
A1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the inside edge/shoulder tread depth. • **Is the tread depth greater than 2/32 in?**	**Yes** ROTATE the wheel and tire assemblies. CHECK and ADJUST the toe to nominal +0.15 degree (toe in). CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 . **No** INSTALL a new tire(s). CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 .

Pinpoint Test B: Outer Edge/Shoulder Wear

This pinpoint test is intended to diagnose the following:

- Excessive toe in
- Incorrect wheel and tire rotation

PINPOINT TEST B: OUTER EDGE/SHOULDER WEAR

Test Step	Result / Action to Take
B1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the outside edge/shoulder tread depth. • **Is the tread depth greater than 2/32 in?**	**Yes** ROTATE the wheel and tire assemblies. CHECK and ADJUST the toe to nominal -0.15 degree (toe out). CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 . **No** INSTALL a new tire(s). CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 .

Pinpoint Test C: Diagonal Wear

This pinpoint test is intended to diagnose the following:

- Incorrect wheel and tire rotation
- Excessive toe in/out
- Incorrect tire inflation
- Loose, worn or damaged suspension components

PINPOINT TEST C: DIAGONAL WEAR

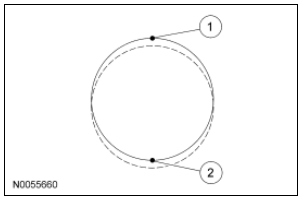
Test Step	Result / Action to Take
C1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the tread depth of the wear pattern. • **Is the tread depth greater than 2/32 in?**	**Yes** If no performance concerns (noise/vibration) are present, the tire can remain in service. CHECK the air pressure in the tires, ADJUST as necessary. ROTATE the wheel and tire assemblies. INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary. CHECK the alignment and ADJUST as necessary. REFER to Section 204-00 .

	No INSTALL a new tire(s). CHECK the air pressure in the tires, ADJUST as necessary. ROTATE the wheel and tire assemblies. INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary. CHECK the alignment and ADJUST as necessary. REFER to Section 204-00 .

Component Tests

Radial Runout

Radial runout is the egg-shaped deviation from a perfect circle and is measured perpendicular to the circumference. On a wheel and tire assembly, this means measuring the center tire tread rib. The center rib is indicative of the condition of the tire as a whole. Total runout is the difference between the maximum-to-minimum gauge reading. The high spot is the location of maximum runout.



Item	Description
1	High spot
2	Low spot

Loaded Runout Measurement (Hunter Road Force® 9700 Series Wheel Balancer)

NOTE: Diagnosis of tire/wheel vibration should not be performed on tires with less than 320 km (200 mi). Some initial tire/wheel vibration issues (such as flat spotting) will correct themselves after the tires have been in service for 320 km (200 mi).

This procedure is intended to assist with the diagnosis of wheel and tire assembly runout and/or force variation issues.

The Hunter Road Force® 9700 Series Wheel Balancer measures the wheel and tire assembly's loaded runout and the tire's radial spring rate. The balancer then converts the runout into pounds of force (termed as Road Force®). Measuring loaded runout (Road Force®) is more effective than measuring unloaded runout using a dial indicator.

1. Using a tire crayon, record the vehicle position on the inward sidewall of all 4 tires.

2. Remove the wheel and tire assemblies. For additional information, refer to Wheel and Tire in this section.

3. **NOTE:** Use only the Digital Tire Gauge any time tire pressures are measured to be sure that accurate values are obtained.

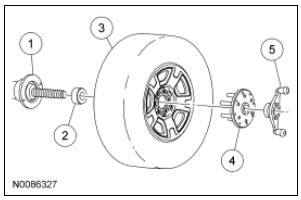
   Make sure that the tire pressures are set to the correct pressure as indicated on the Vehicle Certification (VC) label.

4. ***NOTICE:*** **Make sure that the correct wheel balancer adapters are used when mounting the assembly to the wheel balancer or damage to the wheel may occur.**

   NOTE: Make sure that the wheel and tire assembly is clean and free of foreign material prior to installation on the balancer.

   NOTE: The wheel balancer inflation station must be turned OFF for tires with inflation pressures of 414 kPa (60 psi) or above.

   Mount the wheel and tire assembly on a suitable wheel balancer using the correct wheel balancer adapters as shown. Refer to the list of recommended wheel balancer adapters on the PTS website.



Item	Description
1	Wheel balancer
2	Cone
3	Wheel and tire assembly
4	Finger plate
5	Balancer wing nut

5. Measure the Road Force®.
   - Temporarily mark the high spot and the Road Force® value on the sidewall of the tire. If the wheel and tire assembly Road Force® value is not within 9 kg (20 lb), carry out the Match Mounting procedure to optimize the wheel and tire assembly.
   - If the wheel and tire assembly Road Force® value is within 9 kg (20 lb), permanently mark the high spot and the Road Force® value on the inward sidewall of the tire for reference during future wheel and tire service. Balance the assembly and install the wheel and tire on the vehicle using the Wheel-to-Hub Optimization procedure.

Runout Measurement (Dial Indicator)

NOTE: Diagnosis of tire/wheel vibration should not be performed on tires with less than 320 km (200 mi). Some initial tire/wheel vibration issues (such as flat spotting) will correct themselves after the tires have been in service for 320 km (200 mi).

NOTE: Loaded run-out measurements are the preferred method for verifying tire serviceability. While a dial indicator can be used to optimize the position of the tire on the wheel, the unloaded run-out measurement cannot accurately determine if the tire should be removed from service.

The following procedures should be used if normal diagnostics leads to a potential runout issue.

Some vehicles may exhibit a wheel and tire vibration caused by excessive runout. Radial runout measurements can be taken using a dial indicator and should be measured with the wheel and tire assembly mounted on a suitable wheel balancer. The dial indicator should be mounted securely to eliminate gauge movement when measuring runout.

1. **NOTE:** Use only the Digital Tire Gauge any time tire pressures are measured to be sure that accurate values are obtained.

   Make sure that the tire pressures are set to the correct pressure as indicated on the VC label.

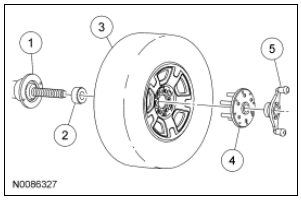
2. Using a tire crayon, record the vehicle position on the inward sidewall of all 4 tires.

3. Remove the wheel and tire assemblies. Refer to Wheel and Tire in this section.

4. ***NOTICE:*** **Make sure that the correct wheel balancer adapters are used when mounting the assembly to the wheel balancer or damage to the wheel may occur.**

   NOTE: Make sure that the wheel and tire assembly is clean and free of foreign material prior to installation on the balancer.

   Mount the wheel and tire assembly on a suitable wheel balancer using the correct wheel balancer adapters as shown. Refer to the list of recommended wheel balancer adapters on the PTS website.



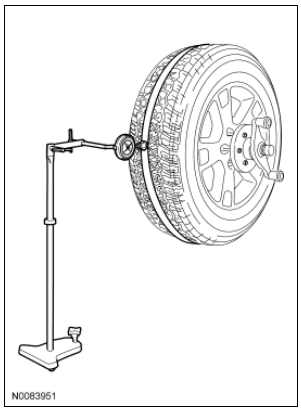
Item	Description
1	Wheel balancer
2	Cone
3	Wheel and tire assembly
4	Finger plate
5	Balancer wing nut

5. **NOTE:** Masking tape can be applied on the center tread rib to allow for a smoother measuring surface. Some fluctuation of the gauge reading is expected. Observe the overall sweep of the gauge from the highest to the lowest spot on the tire.

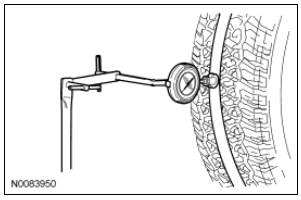
   Position the Dial Indicator and stand with the Dial Indicator on the center tread rib.

   - Rotate the wheel and tire assembly (or wheel) to locate the low spot.
   - Adjust the runout gauge to read 0.

- Rotate the wheel and tire assembly one complete revolution to make sure that the low spot has been found and that the dial indicator returns to a 0 reading.



6. While slowly and constantly rotating the wheel and tire assembly (or wheel), measure the radial runout.
    - Note the variance (runout) from 0 on the dial of the gauge.
    - If the runout reading of a wheel and tire assembly is not within 1.14 mm (0.045 in), locate and temporarily mark the high spot and runout reading on the sidewall of the tire and carry out the Match Mounting procedure to optimize the wheel and tire assembly.
    - If the runout reading of a wheel and tire assembly is within 1.14 mm (0.045 in), permanently mark the high spot and the runout reading on the inward sidewall of the tire for reference during future wheel and tire service. Balance the assembly and install the wheel and tire on the vehicle using the Wheel-to-Hub Optimization procedure.

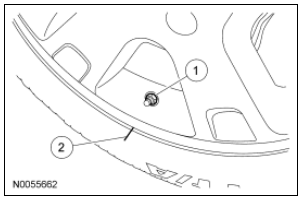


Match Mounting

NOTE: Road Force® values in illustrations are shown in pounds.

Match mounting is a technique used to reduce radial runout or road force on wheel and tire assemblies. Excessive runout is a source of ride quality complaints and match mounting can be used to minimize the runout. Match mounting can be accomplished by changing the position of the tire on the wheel.

1. Position the wheel and tire assembly on a tire machine and put a reference mark on the tire sidewall at the valve stem position.



Item	Description
1	Valve stem

2	Reference mark

2. *NOTICE:* **For tires equipped with a Tire Pressure Monitoring System (TPMS), the sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire from the wheel as instructed in the Disassembly and Assembly procedure. Failure to follow these instructions may result in TPMS component damage.**

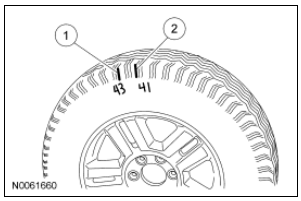
   NOTE: Always make sure that the final high spot and measurement values are permanently marked on the inward sidewall of the tire for reference during future wheel and tire service.

   Using a suitable tire machine, separate the tire beads from the wheel.

   - Lubricate the tire beads using a suitable fast drying, corrosion inhibiting tire bead lubricant.
   - Position the tire 180 degrees (half-way around) on the rim so the valve stem reference mark is now opposite the valve stem.

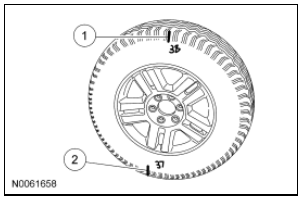
3. Re-inflate the wheel and tire assembly to the specified air pressure and measure the assembly again using the Dial Indicator or Hunter Road Force® 9700 Series Wheel Balancer. Mark the second high spot on the tire.
   - If the runout or Road Force® is reduced to within specifications, the concern has been resolved. Balance the assembly and install on the vehicle using the Wheel-to-Hub Optimization procedure.

4. If the second runout or Road Force® measurement is still not within specification and both high spots are close to each other (within 101.6 mm [4 in]), the root cause is probably the tire (the high spot followed the tire).
   - To be **SURE** that the tire is causing the high runout, it is necessary to have 2 runout or Road Force® measurements that are not within specification and the high spots must be in approximately the same location on the tire's sidewall. If the tire is the cause, install a new tire, balance the assembly and install on the vehicle using the Wheel-to-Hub Optimization procedure.
   - If the second high spot is not within 101.6 mm (4 in) of the first high spot, proceed to the next step.



Item	Description
1	First high spot on the tire
2	Second high spot on the tire

5. If the second high spot is still above specification and is within 101.6 mm (4 in) of being opposite the first high spot on the wheel, the root cause is probably the wheel (the high spot followed the wheel). Dismount the tire from the wheel, mount the wheel on a balancer and check the wheel runout. If the wheel runout exceeds 1.14 mm (0.045 in), install a new wheel, balance the assembly and install on the vehicle using the Wheel-to-Hub Optimization procedure.

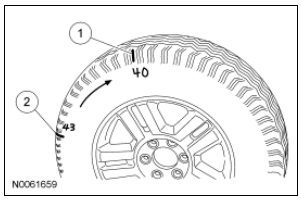


Item	Description
1	First high spot on the tire
2	Second high spot on the tire

6. **NOTE:** If the second high spot did not follow the wheel or the tire and the runout is still not within specification, improvements may be made by rotating the tire 90 degrees (one-quarter of a turn).

   Draw an arrow on the tire sidewall from the second high spot towards the first high spot (in the shortest direction).

   - Separate the tire beads from the wheel and rotate the tire 90 degrees (one-quarter of a turn) in the direction of the arrow.

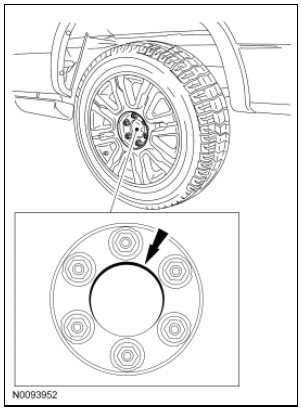


Item	Description
1	First high spot on the tire
2	Second high spot on the tire

Wheel-to-Hub Optimization

Wheel-to-hub optimization is important. Clearance between the wheel and hub can be used to offset or neutralize the Road Force® or run-out of the wheel and tire assembly. For every 0.001 in of wheel-to-hub clearance, the Road Force® can be affected between 1 and 3 lb depending on the tire stiffness.

NOTE: The example below illustrates how the clearance between the wheel and the hub can be used to offset the high spot of radial run-out or Road Force®. Following the procedure will make sure of the best optimization.



1. Position the wheel and tire assembly on the vehicle so that the high spot location is at the 6 o'clock position and install the wheel nuts by hand until snug.

2. **NOTE:** Do not allow the full weight of the vehicle to rest on the tires while tightening the wheel nuts.

   Lower the vehicle until the tires make contact with the ground, slightly loading the suspension. Tighten the wheel nuts as decribed in Wheel and Tire in this section.

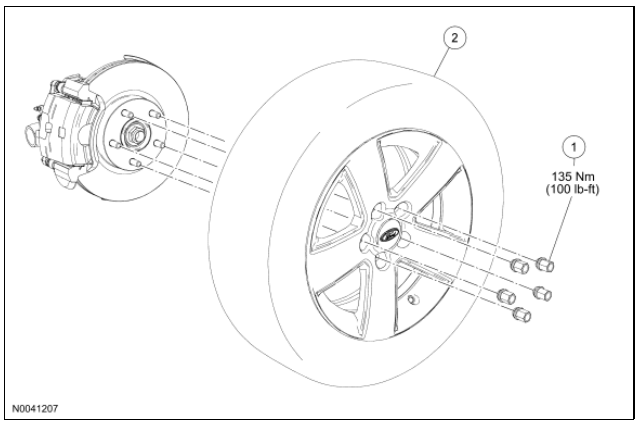
Wheel Leaks

⚠ WARNING: Wheel repairs that use welding or peening are not approved. An inner tube is not an acceptable repair for leaking wheels or tires.

If the air pressure in a tire mounted on an aluminum wheel is found to be low, carry out the following procedure. Failure to follow these instructions may result in personal injury.

1. Remove the tire and wheel assembly and inspect the wheel for structural damage. If the wheel is damaged, install a new wheel.

Wheel and Tire



Item	Part Number	Description
1	1012	Wheel nut (5 required)
2	—	Wheel and tire assembly

Removal

1. If equipped, remove the center cap.
2. **⚠ CAUTION: Do not use heat to loosen a seized wheel nut. Heat can damage the wheel and wheel bearings.**

   With the weight of the vehicle on the tires, loosen the wheel nuts.
3. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
4. **⚠ CAUTION: Do not use heat to loosen a seized wheel because heat can damage the wheel and the wheel bearings. If the wheel cannot be removed by hand, use a wheel puller to remove the seized wheel.**

   Remove the wheel nuts and the wheel and tire assembly.

Installation

1. **⚠ WARNING: When a wheel is installed, always remove any corrosion, dirt or foreign material present on the mounting surfaces of the wheel and the surface of the wheel hub, brake drum or brake disc that contacts the wheel. Installing wheels without correct metal-to-metal contact at the wheel mounting surfaces can cause the wheel nuts to loosen and the wheel to come off while the vehicle is in motion, causing loss of control. Failure to follow these instructions may result in personal injury.**

   NOTE: If there is significant corrosion of the nut or stud threads, lubricate the threads with a drop of oil prior to installation.

   NOTE: When the wheel nuts are used to attach the mini-spare, and are correctly installed, the cone seat of the nut body will be in contact with the cone seat of the wheel. The washer on the nut will not be in contact with the wheel and will spin freely.

Clean the wheel and the wheel hub mounting surface.

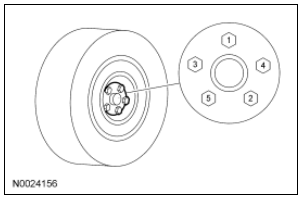
2. Position the wheel and tire assembly and install the wheel nuts.
    - Tighten until snug.

3. **⚠ WARNING: Retighten at 80 km (50 miles) after any wheel change or any time the wheel nuts are loosened. Failure to retighten the wheel nuts at the mileage specified could allow the wheels to come off while the vehicle is in motion, possibly causing loss of control. Failure to follow these instructions may result in personal injury.**

   ⚠ CAUTION: Failure to tighten the wheel nuts in a star pattern can result in high brake disc runout, which will speed up the development of brake roughness, shudder and vibration.

   With the weight of the vehicle on the wheels, tighten the wheel nuts in the sequence shown.

    - Tighten to 135 Nm (100 lb-ft).



Driveline Operating Angles

Front Flex Coupler Operating Angle (deg.)	Rear Flex Coupler Operating Angle (deg.)	Center Support U-joint Operating Angle (deg.)
0°-1°	0°-1°	-4°-1°

Axle Lubricants and Capacities

Lubricant	Specification	Capacity
High Performance Rear Axle Lubricant XY-75W40-QL	WSL-M2C192-A	1.25 liters (2.6 pints)

Driveline System

The drivetrain's power is generated by the engine and delivered to the transmission. The driveline transfers the engine torque through the driveshaft to the axle.

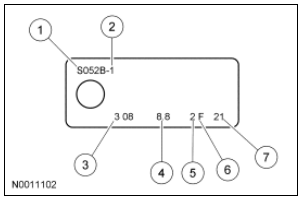
The driveshaft is connected to the output shaft flange on the transmission and to the axle pinion flange. Flex couplers and alignment bushings are used at the ends of the driveshaft to allow for any angular motion. The 2-piece driveshaft has a slip spline, the spline connects the driveshaft halves and is supported by a center bearing. Engine torque enters the axle through the drive pinion, which rotates the ring gear. The ring gear is mounted to the differential case, which contains the gears that transmit power to the axle halfshafts. The differential case is retained by two differential carrier bearings. There is one differential bearing cap, while the right carrier bearing is enclosed by the differential housing. A selective snap ring is used instead of shims on the right side of the differential housing. The axle halfshafts rotate the drive wheels.

The engine angle is built into the engine mounts. If the flex coupler operating angles are out of specification, the engine mounts must be inspected for damage.

Vehicle Certification (VC) Label Example

The vehicle certification (VC) label is located in the driver door jamb. The first 2 digits of the axle code indicate the axle and ratio. For additional information on the VC label, refer to Section 100-01 .

A metal axle identification tag is attached to the differential by a housing cover bolt.



Item	Description
1	Plant code
2	Denotes interchangeability affected internally
3	Axle ratio
4	Ring gear diameter (inch)
5	Build year

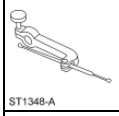
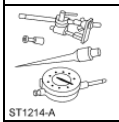
6	Build month
7	Build day

⚠ CAUTION: The axle identification tag is the official service identifier. Do not damage the tag. Always reinstall the tag after removing it for axle inspection/repair.

The axle identification tag identifies a particular axle design and a specific ratio. In addition, the plant code will not change as long as that particular axle assembly never undergoes an external design change. If, however, an internal design change takes place during the production life of the axle and that internal change affects parts interchangeability, a dash and numerical suffix is added to the plant code. This means that as an assembly both axles are interchangeable; however, internally they are different. Therefore, each requires different internal parts at the time of repair.

Driveline System

Special Tool(s)

 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST2456-A	Adapter, Drive Pinion Angle 205-449
ST2457-A	Gauge, Drive Pinion Angle 205-025 (T68P-4602-A)

Inspection and Verification

Certain axle and driveline symptoms are also common to the engine, transmission, wheel bearings, tires and other parts of the vehicle. For this reason, be sure that the cause of the concern is in the axle before disassembling, adjusting or repairing the axle. For additional information, refer to Section 100-04 .

Certain driveshaft vibration symptoms are common to the front engine accessory drive (FEAD), the engine, transmission or tires. Be sure the cause of the concern is the driveshaft before repairing or installing a new driveshaft. For additional information, refer to Section 100-04 .

Axle Noise

A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions, such as a newly paved blacktop road. Slight noise is not detrimental to the operation of the axle and is considered normal.

NOTE: Before disassembling the axle to diagnose and correct gear noise, eliminate the tires, exhaust, trim items, roof racks and wheel bearings as possible causes. Follow the diagnostic procedures in Section 100-04 .

The noises described as follows usually have specific causes that can be diagnosed by observation as the unit is disassembled. The initial clues are the type of noise heard during the road test.

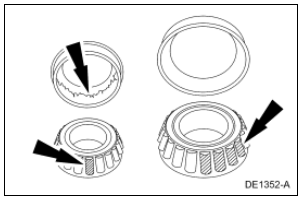
Gear Howl and Whine

Howling or whining of the ring gear and pinion is due to an incorrect gear pattern, gear damage or incorrect bearing preload.

Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by worn/damaged pinion bearings, which are operating at driveshaft speed. Bearing noise occurs at all driving speeds. This distinguishes it from gear whine which usually comes and goes as speed changes.

As noted, pinion bearings make a high-pitched, whistling noise, usually at all speeds. If however there is only one pinion bearing that is worn/damaged, the noise may vary in different driving phases. New pinion bearings must not be installed unless they are scored or damaged or there is a specific pinion bearing noise. A worn/damaged bearing will normally be obvious at disassembly. Examine the large end of the rollers for wear. If the pinion bearings original blend radius has worn to a sharp edge, a new pinion bearing must be installed.



A wheel bearing noise can be mistaken for a pinion bearing noise. Check the wheel bearing for a spalled cup and spalled/damaged rollers. Install a new wheel bearing if any of these concerns are detected.

Chuckle

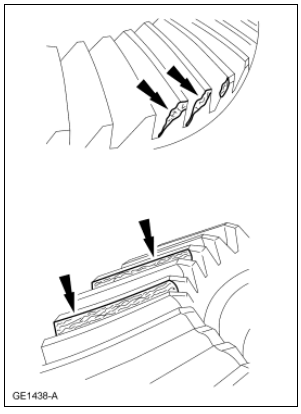
Chuckle that occurs on the coast driving phase is usually caused by excessive clearance between the differential gear hub and the differential case bore.

Damage to a gear tooth on the coast side can cause a noise identical to a chuckle. A very small tooth nick or ridge on the edge of a tooth can cause the noise.

Clean the gear tooth nick or ridge with a small grinding wheel. If the damaged area is larger than 3.2 mm (1/8 inch), install a new gearset.

To check the ring gear and pinion, remove as much lubricant as possible from the gears with clean solvent. Wipe the gears dry or blow them dry with compressed air. Look for scored or damaged teeth. Also look for cracks or other damage.

If either gear is scored or badly damaged, a new ring gear and pinion must be installed.



If metal has broken loose, the axle housing must be cleaned to remove particles that will cause damage. At this time, any other damaged parts in the axle housing must also be installed new.

Clunk

Clunk is a metallic noise heard when the automatic transmission is engaged in REVERSE or DRIVE. The noise can also occur when throttle is applied or released. It is caused by backlash somewhere in the driveline or loose suspension components; it is felt or heard in the axle.

Additionally, clunk may be heard upon initial drive-away. This occurs as engine torque shifts vehicle weight, forcing changes in driveline angles which prevent the driveshaft slip-yoke from sliding on the output shaft. To correct this condition, lubricate the slip-yoke splines.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a worn/damaged wheel bearing. The lower pitch is because the wheel bearing turns at only about one-third the speed of the driveshaft. Wheel bearing noise also may be high-pitched, similar to gear noise, but will be evident in all four driving modes.

Flex Coupling Inspection

Check for visible signs of tearing, cracking or wear in the reinforcing cord. If the flex couplings show signs of damage, inspect the axle and subframe mounts for cracking or tearing.

Driveshaft Center Bearing

Rotate the driveshaft by hand. If the bearing shows signs of roughness or is noisy, install a new bearing assembly.

Analysis of Leakage

Clean up the leaking area enough to identify the exact source. An axle leak can be caused by the following:

- Axle lubricant level is too high.
- Worn or damaged halfshaft seals or differential seals.
- Axle housing is cracked.
- Flange yoke seal is worn or damaged.
- Pinion flange is scored or damaged.
- Axle cover is not sealed.
- Vent is plugged.

Repair the axle as necessary. Make sure the axle lubricant is at the correct level. For additional information, refer to Specifications in this section.

Axle Vent

NOTE: If a plugged vent cannot be cleared, install a new vent.

A plugged vent will cause excessive seal lip wear due to internal pressure buildup. If a leak occurs, check the vent.

Flange Yoke Seal

Leaks at the axle drive pinion seal originate for the following reasons:

- Seal is not correctly installed.
- Damaged seal journal surface.

Any damage to the seal bore (dings, dents, gouges or other imperfections) will distort the seal casing and allow leakage past the outer edge of the axle drive pinion seal.

The axle drive pinion seal can be torn, cut or gouged if it is not installed carefully. The spring that holds the axle drive pinion seal against the pinion flange can be knocked out, which can allow leakage past the lip.

The rubber lips can occasionally become hard (like plastic) with cracks at the oil lip contact point. The contact point on the pinion flange may blacken, indicating excessive heat. Marks, nicks, gouges or rough surface texture on the seal journal of the pinion flange will also cause leaks.

A new pinion flange must be installed if any of these conditions exist.

Metal chips or sand trapped at the sealing lip can also cause oil leaks. This can cause a wear groove on the pinion flange and heavy pinion seal wear.

When a seal leak occurs, install a new seal and check the vent.

Differential Seals

Stub shaft pilot bearing housing seals are susceptible to the same kinds of damage as axle drive pinion seals if they are incorrectly installed. The seal bore must be clean and the lip handled carefully to avoid cutting or tearing it. The seal journal surface must be free of nicks, gouges and rough surface texture.

Analysis of Vibration

Few vibration conditions are caused by the rear axle. For a vibration concern, follow the diagnosis procedure in Section 100-04 unless there is a good reason to suspect the axle.

Tires

⚠ WARNING: Do not balance the wheels and tires while they are mounted on the vehicle. Possible tire disintegration or differential failure could result, causing personal injury or extensive component damage. Use an off-vehicle wheel and tire balancer only.

Most vibration is caused by tires, driveline angle or driveline imbalance.

Vibration is a concern with modern, high-mileage tires if they are not "true" both radially and laterally. They are more susceptible to vibration around the limits of radial and lateral runout of the tire and wheel assembly. They also require more accurate balancing. Wheel and tire runout checks, trueing and balancing are normally done before axle inspection. For additional information, refer to Section 204-04 .

Driveline Imbalance

Driveline imbalance can be caused by excessive looseness in the driveshaft, damaged driveshaft tubing, looseness or high runout at the driveshaft attachments. Excessive looseness in the driveshaft can be caused by CV joint or universal joint wear as well as loose fitting slip-yoke splines. Inspect and install new driveshaft components as necessary.

Symptom Chart

Symptom Chart

Component Tests

Driveline Angle

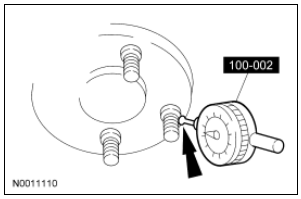
Driveline operating angularity is the angular relationship between the input and output sides of any flex coupling or universal joint. Some of the factors determining driveline angularity include ride height, rear spring, and engine mounts. Refer to Driveline Angle Measurement in this section.

If the tires and driveline angle are not the cause, carry out the NVH tests to determine whether the concern is caused by a condition in the axle. For additional information, refer to Section 100-04 .

Wheel Hub Bolt Circle Runout

NOTE: The brake discs must be removed to carry out all runout measurements.

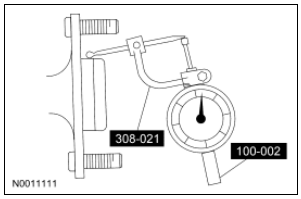
1. Position the special tool on the wheel hub bolt, as close to the hub face as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub until the next bolt is contacted. Record the measurement and continue until each bolt is checked. The difference between the maximum and minimum contact readings will be the total wheel hub bolt circle runout. The runout must not exceed 0.38 mm (0.015 inch).

Pilot Runout

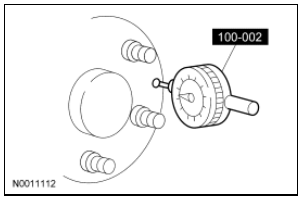
1. Position the special tools on the pilot, as close to the hub as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub one full turn and note the maximum and minimum readings. The difference between the maximum and minimum readings will be the total pilot runout. Pilot runout must not exceed 0.15 mm (0.006 inch).

Wheel Hub Runout

1. Position the special tool on the wheel hub, as close to the outer edge as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub one full turn and note the maximum and minimum readings. The difference between the maximum and minimum readings will be the total wheel hub runout. The runout must not exceed 0.127 mm (0.005 inch).

Driveshaft Vibration Diagnosis

1. Road test the vehicle to determine the critical vibration points. Note the road speed, the engine RPM, and the shift lever positions at which the vibration occurs.

2. Stop the vehicle, place the transmission lever in NEUTRAL and run the engine through the critical speed ranges determined in Step 1.

3. If no vibration is felt, refer to Driveshaft Runout and Balancing in this section.

Driveline Angle Measurement

Special Tool(s)

ST1622-A	Anglemaster II Driveline Inclinometer/Protractor 164-R2402 or equivalent

NOTE: This procedure does not apply to CV joints, flex couplers or double cardan joints that are used in some driveshafts. This check is for single-cross and roller-style joints found in the driveshafts.

NOTE: Prior to checking driveline angularity, inspect the U-joints for correct operation.

NOTE: An incorrect driveline angle can cause a vibration or shudder. For additional information, refer to Section 100-04 .

NOTE: Driveline angularity is the angular relationship between the engine crankshaft, the driveshaft and the rear axle pinion. Factors determining driveline angularity include ride height, rear spring and engine mounts.

All vehicles

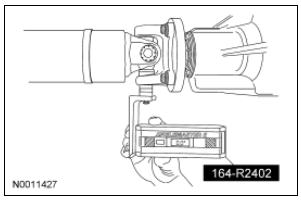
1. Carry out the following preliminary setup steps:
   - Inspect the U-joints for correct operation.
   - Park the vehicle on a level surface such as a drive-on hoist, or back onto a front end alignment rack.
   - Verify the curb position ride height is within specifications with the vehicle unloaded and all of the tires are inflated to their normal operating pressures.
   - Calibrate the Anglemaster II Driveline Inclinometer/Protractor by placing it on a clean, flat level section of the frame rail and press the ALT-ZERO button.

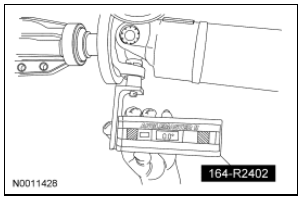
Vehicles with flat-flanged, split-pin or slip-flanged U-joints

2. **NOTE:** If equipped, remove the snap ring to allow access to the base of the U-joint cup. Make sure the Anglemaster II Driveline Inclinometer/Protractor is seated against the U-joint cup.

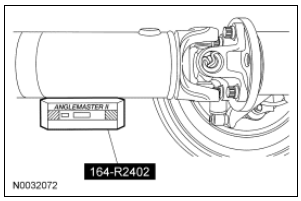
   NOTE: Rotate the driveshaft until the flange U-joint cup is parallel with the floor. This will simplify taking measurements.

   To check the U-joint operating angle, install the Anglemaster II Driveline Inclinometer/Protractor. Check and record the flange angle as angle A.





3. Using the Anglemaster II Driveline Inclinometer/Protractor, measure the slope of the connecting component. Record the measurement of the component angle as angle B.

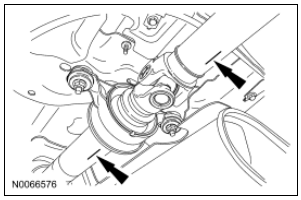


Multiple piece driveshafts

4. **NOTE:** Repeat this step for each center support bearing on the driveshaft.

   NOTE: It is not necessary to remove the U-joint snap ring, if equipped, for these measurements.

   Using the Anglemaster II Driveline Inclinometer/Protractor, measure the slope of the components in front and behind the center support bearing U-joint in the area indicated. Record the front component as angle A and the rear component as angle B.



All vehicles

5. **NOTE:** When 2 connected components slope in the same direction, subtract the smallest number from the larger number to find the U-joint operating angle. When 2 connected components slope in the opposite direction, add the measurements to find the U-joint operating angle.

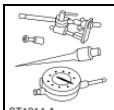
   Calculate the difference in the slope of the components to determine the U-joint operating angle.

   - The U-joint operating angle is the angle formed by 2 yokes connected by a cross and bearing kit. Ideally, the operating angles on each connection of the driveshaft must:
     - ♦ be equal or within one degree of each other.
     - ♦ have a 3 degree maximum operating angle.
     - ♦ have at least one-half of one degree continuous operating angle.

6. If the angle is not within specifications, repair or adjust to obtain the correct angle. Inspect the engine mounts, transmission mounts, center support bearing mounting, rear suspension, rear axle, rear axle mounting or the frame for wear or damage.

Driveshaft Runout and Balancing

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST3025-A	Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) 257-00018 or equivalent

Driveshaft Inspection

NOTE: Driveline vibration exhibits a higher frequency and lower amplitude than high-speed shake. Driveline vibration is directly related to the speed of the vehicle and is noticed at various speeds. Driveline vibration can be perceived as a tremor in the floorpan or heard as a rumble, hum or boom.

NOTE: Refer to Specifications in this section for all runout specifications.

1. **NOTE:** Do not make any adjustments before carrying out a road test. Do not change the tire pressure or the vehicle load.

   Carry out a visual inspection of the vehicle. Operate the vehicle and verify the condition by reproducing it during the road test.

   - The concern should be directly related to vehicle road speed, not affected by acceleration or deceleration or could not be reduced by coasting in NEUTRAL.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
   - The driveshaft should be kept at an angle equal to or close to the curb-weighted position. Use a twin-post hoist or a frame hoist with jackstands.

3. Inspect the driveshaft for damage, undercoating or incorrectly seated U-joints. Rotate the driveshaft slowly by hand and feel for binding or end play in the U-joint trunnions. Remove the driveshaft. For additional information, refer to Section 205-01 . Inspect the slip yoke splines for any galling, dirt, rust or incorrect lubrication. Clean the driveshaft or install new U-joints as necessary. Install a new driveshaft if damaged. After any corrections or new components are installed, recheck for the vibration at the road test speed.
   - If the vibration is gone, test drive the vehicle.
   - If the vibration persists or the driveshaft passes visual inspection, measure the driveshaft runout.

Driveshaft Runout

1. Install the Dial Indicator Gauge with Holding Fixture. Rotate the driveshaft by turning the axle and measure the runout at the front, the center and the rear of the driveshaft.
   - If the runout exceeds 1 mm (0.040 in) at the front or center, install a new driveshaft.

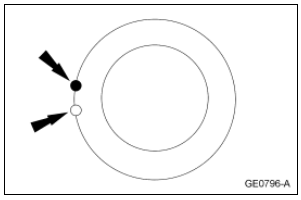
- If the front and center is within 1 mm (0.040 in), but the rear runout is not, index-mark the rear runout high point and proceed to Step 2.
- If the runout is within 1 mm (0.040 in) at all points, recheck for vibration at road test speed. If the vibration persists, balance the driveshaft. For additional information, refer to Driveshaft Balancing in this procedure.

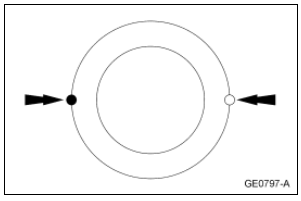
2. **NOTE:** Circular pinion flanges can be turned in 90 degree or one-fourth increments. Half-round pinion flanges are limited to 2 positions.

   Index-mark the driveshaft to the pinion flange. Disconnect the driveshaft and rotate it 180 degrees. Reconnect the driveshaft. Recheck the runout at the rear of the driveshaft.

   - If the runout is still over specification, mark the high point and proceed to Step 3.
   - If the runout is within specification, check for the vibration at the road test speed. If the vibration is still present, balance the driveshaft. For additional information, refer to Driveshaft Balancing in this procedure.

3. Excessive driveshaft runout can originate in the driveshaft itself or from the pinion flange. To find the source, compare the 2 high points previously determined.
   - If the index marks are close together, within 25 mm (1 in), the driveshaft is eccentric. Install a new driveshaft.
   - If the marks are on opposite sides of the driveshaft, 180 degrees apart, the slip yoke or pinion flange is responsible. Check the pinion flange runout. If the pinion flange runout exceeds specifications, a bent pinion is indicated.
   - If the pinion flange and pinion runouts are within specifications, road test and check for the vibration at the road test speed. If the vibration persists, balance the driveshaft. For additional information, refer to Driveshaft Balancing in this procedure.





Driveshaft Balancing — Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)

All vehicles

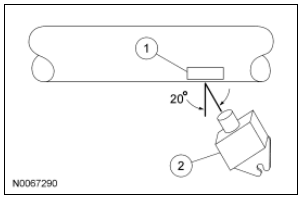
1. Install the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) to the vehicle.

2. Working under the vehicle, install an accelerometer. The accelerometer can be attached and mounted near either the transmission or differential end of the driveshaft.

3. Clean an area of the driveshaft and install the reflective tape, then install the photo-tachometer sensor. The sensor should be placed at approximately a 20-degree angle from perpendicular to the surface of

the reflective tape. Make sure the sensor does not get moved during the balance procedure.

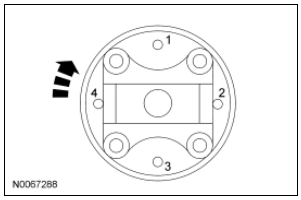
1. Reflective tape.
2. Photo-tachometer sensor.



4. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a driveshaft balance test with the driveshaft unmodified.

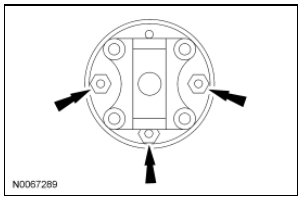
Vehicles with tapped pinion flanges

5. Label the tapped holes in the pinion flange numerically, starting at the top hole as 1. Mark the remaining holes 2, 3 and 4. Label in the direction of rotation.



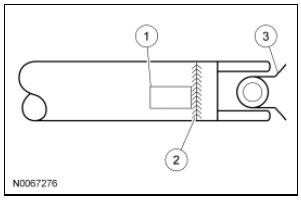
6. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a second test with the 12 mm (0.47 in) test weight set screw in the No. 1 hole, previously marked on the pinion flange.

7. Remove the test weight, then install the weight combination directed by the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix).

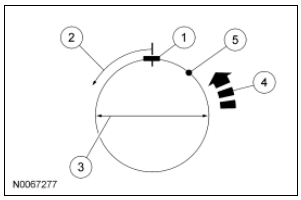


Vehicles without tapped pinion flanges

8. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a second test with a test weight. Using a metal band, secure the test weight to the end of the driveshaft. The weight should be placed at the end of the driveshaft tube, as close to the tube-to-yoke weld seam as possible. Mark the location of the test weight on the driveshaft, as shown in the figure below.
    1. Test weight.
    2. Tube-to-yoke weld seam.
    3. Driveshaft pinion flange.
    - Select the test weight based on driveshaft size. Larger driveshafts use 10 g (0.353 oz). Smaller driveshafts use 5 g (0.176 oz).



9. Remove the test weight, then install the recommended weight at the position directed by the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix). Using a metal band and epoxy, secure the test weight to the driveshaft, as shown in the figure below.
    1. Test weight.
    2. Measure in this direction.
    3. Driveshaft diameter.
    4. Directional rotation.
    5. Balance weight relative to test weight centerline.
    - The results are displayed with respect to the location to where the test weight was placed.



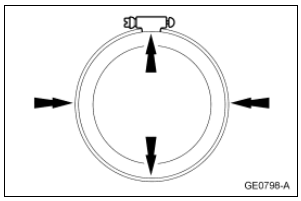
All vehicles

10. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a third test to verify the repair.

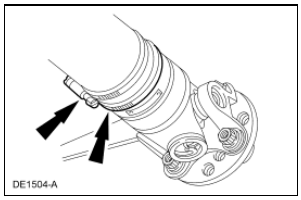
Driveshaft Balancing — Hose Clamp Method

1. Install 1 or 2 hose clamps on the driveshaft, near the rear. Position of the hose clamp head(s) can be determined through trial and error.

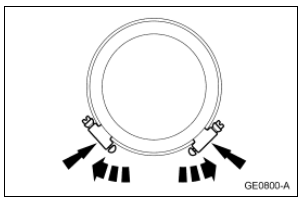
2. Mark the rear of the driveshaft into 4 approximately equal sectors and number the marks 1 through 4. Install a hose clamp on the driveshaft with its head at position No. 1, as shown in the figure below. Check for vibration at road speed. Recheck with the clamp at each of the other positions to find the position that shows minimum vibration. If 2 adjacent positions show equal improvement, position the clamp head between them.



3. If the vibration persists, add a second clamp at the same position and recheck for vibration.



4. If no improvement is noted, rotate the clamps in opposite directions, equal distances from the best position determined in Step 2. Separate the clamp heads about 13 mm (1/2 in) and recheck for vibration at the road speed.



5. Repeat the process with increasing separation until the best combination is found or the vibration is reduced to an acceptable level.

Torque Specifications

Description	Nm	lb-ft
Flex coupling-to-flange bolt nuts	81	60
Center support bearing bolts	43	32

General Specifications

Item	Specification
Premium Long-Life Grease XG-1-C	ESA-M1C75-B
Threadlock 262 TA-26	WSK-M2G351-A6

Balance Nuts

Kit Part Number	Color	Weight (grams)
XW4Z-4613-AA	Red	1.23
	Silver	2.75
	Green	5.6
	Black	4.0

Driveshaft

⚠ CAUTION: All driveshaft assemblies are balanced. If undercoating the vehicle, protect the driveshaft to prevent overspray of any undercoating material.

The driveshaft is a 2-piece design. A single center U-joint and a slip yoke connect the driveshaft assemblies. The front and rear shafts are separable at the slip yoke. It is imperative to index-mark the assemblies before separation to prevent an imbalance condition. The driveshaft uses flex couplings at each end of the shaft that take the place of traditional U-joints. The driveshaft has alignment bushings at each end of the shaft. These bushings align the driveshaft with the pilot stems on the transmission output shaft and the axle drive pinion stem. Only remove the flex couplings from the driveshaft if it is necessary to install new flex couplings/alignment bushings. Always install a new alignment bushing and flex coupling as a pair.

The driveshaft has traditional balance weights attached (spot-welded) by the manufacturer. The final driveshaft balance occurs, with the complete drivetrain assembly at vehicle assembly, by attaching weighted color-coded nuts to the axle flex coupling bolts. For this reason, the rear flex coupling bolts are longer than the front transmission flex coupling bolts. Always install the driveshaft flex coupling bolts with the head of the bolt seated against the flange, and the nuts seated against the flex coupling.

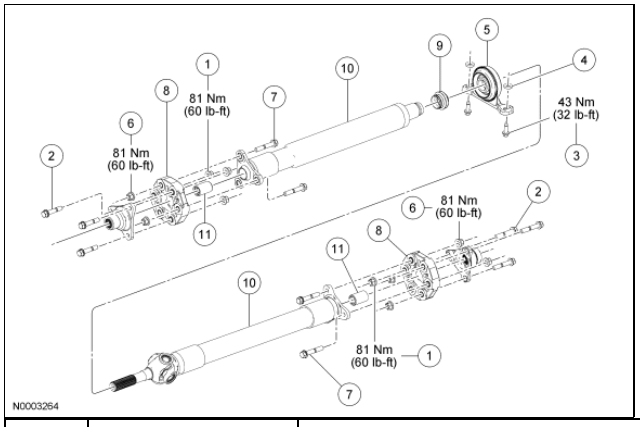
Driveshaft

Refer to Section 205-00 .

Driveshaft

Material

Item	Specification
Premium Long-Life Grease XG-1-C or equivalent	ESA-M1C75-B
Threadlock 262 TA-26	WSK-M2G351-A6



Item	Part Number	Description
1	W705575-S301	Flex coupling-to-flange bolt nuts (3 required)
2	W705098-S301	Flex coupling-to-flange bolts (3 required)
3	N897487-S56	Center support bearing bolts (2 required)
4	—	Center support adjusting washer (selective)
5	4A499	Center bearing and bracket assembly
6	W705575-S301	Flex coupling-to-driveshaft bolt nuts (3 required)
7	W705098-S301	Flex coupling-to-driveshaft bolts (3 required)
8	4782	Flex coupling (2 required)
9	4421	Driveshaft slip yoke boot
10	4602	Driveshaft assembly
11	4650	Alignment bushing (2 required)

Removal

1. ⚠ **CAUTION: Only remove the flex couplings from the driveshaft if it is necessary to install new flex coupling/alignment bushings. Install new alignment bushings and flex couplings as a pair. Balance the driveshaft with the flex couplings installed.**

   With the vehicle in NEUTRAL, position on a hoist. For additional information, refer to Section 100-02 .

2. Remove the retainers for the muffler, resonator and tail pipe assembly.

3. Disconnect the exhaust hangers.

4. Separate and lower the muffler, resonator and tail pipe assembly.

5. Remove the heat shield.

6. ⚠ **CAUTION: To make sure assembly is in the exact same location, index-mark the bolt, nut, washer, flex coupling and pinion flange with paint or marker. Using a different color paint or marker, index-mark the 2nd bolt, nut and washer that retain the driveshaft and flex coupling to the pinion flange and the transmission flange. Do not index-mark the 3rd bolt, nut and washer that retain the driveshaft and flex coupling to the pinion flange. These fasteners are balance weights. Always assemble them in their original positions. Failure to do so can cause a driveshaft NVH concern.**

   Index-mark the components.

7. ⚠ **CAUTION: Do not remove the flex coupling-to-driveshaft bolts.**

   NOTE: The bolt heads are serrated. Hold the bolt and loosen the nut.

   Remove the 3 flex coupling-to-flange bolt nuts and flex coupling-to-flange bolts.

8. ⚠ **CAUTION: Do not remove the flex coupling-to-driveshaft bolts.**

   NOTE: The bolt heads are serrated. Hold the bolt and loosen the nut.

   Remove the 3 flex coupling-to-flange bolt nuts and flex coupling-to-flange bolts.

9. **NOTE:** Index-mark the driveshaft on both sides of the slip joint.

   Slide the front shaft assembly rearward.

10. Remove the center support bearing bolts, then the driveshaft assembly.

Installation

1. Add 1 gram of grease to both alignment bushing cavities.

2. ⚠ **CAUTION: Align the index marks or a driveshaft NVH concern can occur.**

   Align the index marks and position the alignment bushing on the pinion flange piloting stem.

3. ⚠ **CAUTION: Install the selective spacers and bolts in their original positions.**

   NOTE: Do not tighten the bolts at this time.

   Install the center support bearing bolts hand-tight.

4. Slide the front shaft assembly forward.

5. ⚠ **CAUTION: Align the index marks or driveshaft NVH can occur.**

   Align the index marks and position the alignment bushing on the transmission flange piloting stem.

6. ⚠ **CAUTION: Install the bolts, washers and nuts in their original positions or a driveshaft NVH concern can occur. Install the driveshaft flex coupling bolts with the head of the bolt**

seated against the flange, and the nuts seated against the flex coupling. Install the short bolts in the transmission flange and the long bolts in the drive pinion flange.

NOTE: The bolt heads are serrated. Hold the bolt and tighten the nut.

Install all 6 of the flex coupling-to-flange bolt nuts and flex coupling-to-flange bolts.

- Coat the nut and bolt threads with Threadlock 262.
- Tighten to 81 Nm (60 lb-ft).

7. ⚠ **CAUTION: Tighten the center support bearing bolts evenly to avoid twisting the bracket.**

   Tighten the center support bearing bolts.

   - Tighten to 43 Nm (32 lb-ft).

8. Install the heat shield.

9. Install the exhaust system. For additional information, refer to Section 309-00 .

Driveshaft Alignment Bushing

Special Tool(s)

ST1144-A	Universal Puller Set 303-DS005 (D80L-100A) or equivalent
ST2454-A	Driveshaft Alignment Bushing Remover Tube 205-D073 or equivalent
ST1255-A	Adapter For 303-224 205-153 (T80T-4000-W)
ST1508-A	Driveshaft Alignment Bushing Installer 205-D074 or equivalent

Material

Item	Specification
Threadlock 262 TA-26	WSK-M2G351-A6
Premium Long-Life Grease XG-1-C	ESA-M1C75-B

Disassembly

1. Remove the driveshaft. For additional information, refer to Driveshaft in this section.

2. Separate the front driveshaft from the rear shaft.

3. **NOTE:** The bolt heads are serrated. Hold the bolt and loosen the nut.

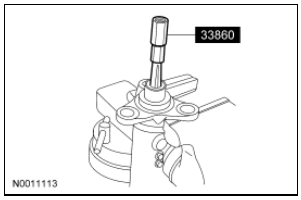
   Index-mark and remove the flex coupling-to-driveshaft bolt nuts, the flex coupling-to-driveshaft bolts and the flex coupling.

   - Discard the flex coupling. Retain the flex coupling-to-driveshaft bolt nuts and flex coupling-to-driveshaft bolts.

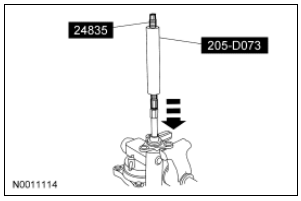
4. ⚠ **CAUTION: Do not clamp the vise on the driveshaft tube as a fracture can result.**

   Position the driveshaft end yoke in the vise jaws.

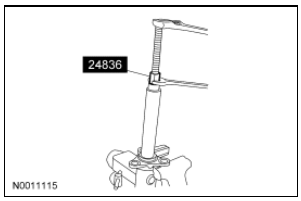
5. Insert the special tool inside the alignment bushing and expand the collet.



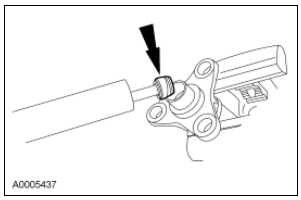
6. Install the special tools.



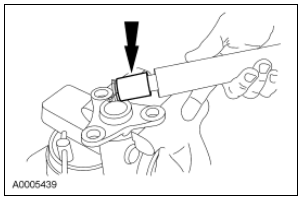
7. Hold the forcing screw and tighten the forcing screw nut until the alignment bushing inner core is removed.



8. Discard the alignment bushing inner core.



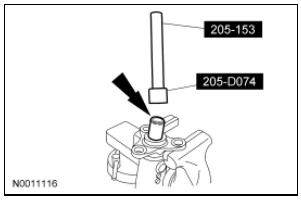
9. Insert the special tool and expand the collet to seat behind the bushing shell.
10. Install the special tools.
11. Hold the forcing screw and tighten the forcing screw nut until the alignment bushing outer shell is removed.
12. Discard the alignment bushing outer shell.



Assembly

1. **NOTE:** Install the alignment bushing with the seal facing outboard.

   Using the special tools, align the bushing with the driveshaft.



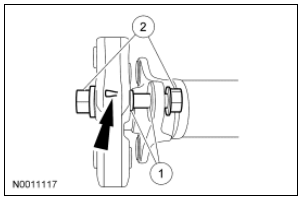
2. Using the special tools, drive the alignment bushing until the tool contacts the end yoke face.

3. ⚠ **CAUTION: There are 6 bushings in each flex coupling. Three of the bushings protrude from one side of the flex coupling and 3 protrude from the other side. The arrows on the side of the flex coupling point toward the protruding end of the bushing. When installing the flex coupling, the protruding end of the bushing must seat in the driveshaft flange counterbore or damage will occur to the flex coupling during driveshaft operation.**

   Install the flex coupling.

   1. Position the protruding end of the bushing against the driveshaft flange.
   2. ⚠ **CAUTION: The bolt heads must seat against the driveshaft flange and the nuts against the flex coupling.**

      Install the flex coupling-to-driveshaft bolt nuts and flex coupling-to-driveshaft bolts in their original locations.



4. **NOTE:** The bolt heads are serrated. Hold the bolt and tighten the nut.

   Tighten the flex coupling-to-driveshaft bolt nuts and flex coupling-to-driveshaft bolts.

   - Coat the bolt threads with Threadlock 262.
   - Tighten to 81 Nm (60 lb-ft).

5. Repeat for the other end of the driveshaft.

6. ⚠ **CAUTION: Align the index marks or driveshaft imbalance can occur.**

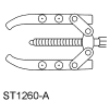
   Assemble the front driveshaft to the rear shaft.

7. ⚠ **CAUTION: Add 1 gram of grease to both alignment bushing cavities before installing the driveshaft.**

   Install the driveshaft. For additional information, refer to Driveshaft in this section.

Driveshaft Center Bearing

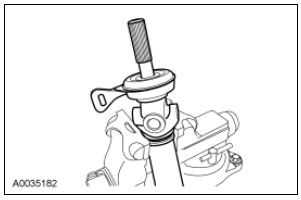
Special Tool(s)

 ST1260-A	2-Jaw Puller 205-D026 (D80L-1002-L) or equivalent
ST1368-A	Puller, Bearing 205-D064 (D84L-1123-A) or equivalent
ST2454-A	Driveshaft Alignment Bushing Remover Tube 205-D073 or equivalent

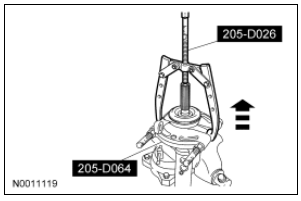
Disassembly

1. Remove the driveshaft. For additional information, refer to Driveshaft in this section.
2. Separate the front driveshaft from the rear shaft.
3. ⚠ **CAUTION: Do not clamp on the driveshaft tube as a fracture can result.**

   Position and clamp the driveshaft at the weld yoke.

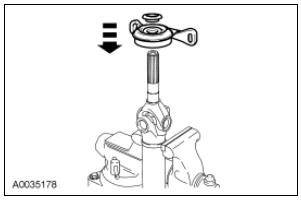


4. Using the special tools, remove the retaining ring and the center bearing and bracket assembly.

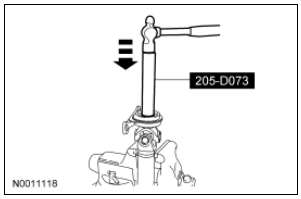


Assembly

1. Position the center bearing and bracket assembly and the retaining ring on the yoke.



2. Using the special tool, drive the retaining ring and bearing assembly until fully seated on the yoke.



3. Assemble the front and rear shaft assemblies.

4. Install the driveshaft. For additional information, refer to Driveshaft in this section.

General Specifications

Description	mm	in
Clearance, Tolerance and Adjustments		
Maximum differential case runout	0.076	0.003
Maximum pinion stem radial runout in assembly	0.25	0.010
Backlash between ring gear teeth and pinion teeth	0.127-0.228	0.005-0.009
Maximum backlash variation between teeth	0.076	0.003
Available drive pinion bearing adjustment shim in steps of: 0.0254 mm (0.001 inch) 8.0 inch axle	0.254-0.965	0.010-0.038

Lubricant Capacities

Liters	Pints
1.25	2.6 [a]

[a] Fill the rear axle 3-5 mm (1/8-3/16 inch) from the bottom of filler hole.

General Specifications

Item	Specification
Lubricants/Sealants	
Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B
Threadlock 262 TA-26	WSK-M2G351-A6
Motorcraft SAE 75W-140 High Performance Rear Axle Lubricant XY-75W-140-QL	WSL-M2C192-A
Clear Silicone Rubber TA-32	ESB-M4G92-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Stud and Bearing Mount TA-27	WSK-M2G349-A1
Pipe Sealant with PTFE TA-24	WSK-M2G350-A2

Torque Specifications

Description	Nm	lb-ft	lb-in

Bearing cap bolt	105	77	—
Ring gear bolt	120	89	—
Differential housing cover bolt	32	24	—
Filler plug	34	25	—
Rear axle differential front lower insulator nuts and bolts	90	66	—
Rear axle differential rear insulator bolt	150	111	—
Pinion bearing preload	1.8-3.3	—	16-29
Rear axle hub nut	300	221	—

Rear Drive Axle and Differential

The rear axle assembly contains the following features:

- An integral-type housing hypoid gear design which has the centerline of pinion set below the centerline of ring gear.
- A hypoid ring gear and pinion consists of a 203 mm (8.0 inch) diameter ring gear and an overhung drive pinion which is supported by 2 opposed tapered roller bearings.
- Pinion bearing preload is maintained by a drive pinion collapsible spacer on the pinion shaft and adjusted by the pinion nut.
- A rear axle housing assembly which consists of a differential carrier and a cast-aluminum rear differential housing cover.
- A differential housing cover which uses silicone sealant rather than a gasket.
- A differential case which is a 1-piece design with 2 openings to allow for assembly of internal components and lubricant flow.
- A differential pinion shaft which is retained by a threaded differential pinion shaft lock bolt assembled to the differential case.
- A differential case which is mounted in the rear axle housing between 2 opposed differential bearings.
- Differential bearings which are retained in the rear axle housing by one removable bearing cap.
- Differential bearing preload and ring gear backlash which are adjusted by differential bearing shims located between the differential bearing cup and the rear differential housing.
- The use of a pinion depth gauge is required for correct differential ring gear and pinion adjustment.
- The halfshafts are held in the differential case by a circlip that is located on the inboard CV joint stub shaft. When each halfshaft is installed, the circlip engages a groove in the differential side gear.

The rear drive axle operates as follows:

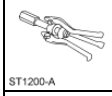
- The rear axle drive pinion receives power from the engine through the transmission and driveshaft.
- The pinion gear rotates the ring gear which is bolted to the differential case outer flange.
- Inside the differential case 2 differential pinion gears are mounted on a differential pinion shaft which is pinned to the differential case.
- These differential pinion gears are meshed with the differential side gears to which the halfshafts are splined.
- As the differential case turns it rotates the halfshafts.
- When it is necessary for 1 wheel and halfshaft to rotate faster than the other, the faster turning differential side gear causes the differential pinion gears to roll on the slower turning differential side gear. This allows differential action between the 2 halfshafts.

Rear Drive Axle and Differential

Refer to Section 205-00 .

Stub Shaft Pilot Bearing and Seal

Special Tool(s)

 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
ST2027-A	Installer, Differential Oil Seal 205-539
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)

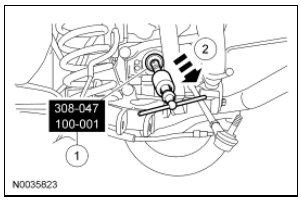
Material

Item	Specification
Motorcraft SAE 75W-140 High Performance Rear Axle Lubricant XY-75W-140-QL	WSL-M2C192-A
Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B

Removal

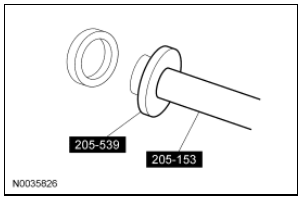
1. Remove the halfshaft assembly. For additional information, refer to Section 205-05 .

2. Remove the inboard CV joint stub shaft pilot bearing housing seal.
    1. Install the special tools with the tangs firmly engaged on the inboard CV joint stub shaft seal.
    2. Remove the inboard CV joint stub shaft pilot bearing housing seal.



Installation

1. Lubricate the lip of the inboard CV joint stub shaft pilot bearing housing seal with grease. Place the inboard CV joint stub shaft pilot bearing housing seal onto the special tools.



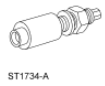
2. ⚠ **CAUTION: Installation of the inboard CV joint stub shaft pilot bearing housing seal without the correct tool can result in early inboard CV joint stub shaft pilot bearing housing seal failure. If the inboard CV joint stub shaft pilot bearing housing seal becomes cocked during installation, remove it and install a new one.**

   Carefully align the inboard CV joint stub shaft pilot bearing housing seal with the housing bore, then install the inboard CV joint stub shaft pilot bearing housing seal.

3. Install the halfshaft assembly. For additional information, refer to Section 205-05 .

Drive Pinion Flange and Drive Pinion Seal

Special Tool(s)

ST2458-A	Holding Tool, Drive Pinion Flange 205-478
 ST1734-A	Installer, Drive Pinion Flange 205-479
ST2452-A	Remover, Output Flange 307-408
ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)

Material

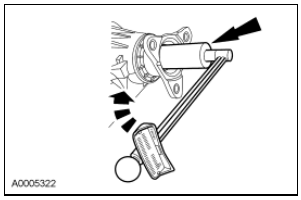
Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the rear wheel and tire assemblies. For additional information, refer to Section 204-04 .
3. **⚠ CAUTION: Remove the rear brake calipers to prevent drag during the drive pinion bearing preload adjustment.**

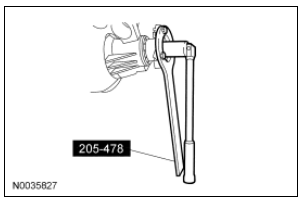
   ⚠ CAUTION: Do not allow the calipers to hang from the brake hoses.

   Remove the rear brake caliper and support bracket as an assembly. Wire the caliper and support bracket out of the way.
4. Remove the driveshaft assembly. For additional information, refer to Section 205-01 .
5. Using a Nm (lb-in) torque wrench on the pinion nut, record the torque necessary to maintain rotation of the drive pinion gear through several revolutions.

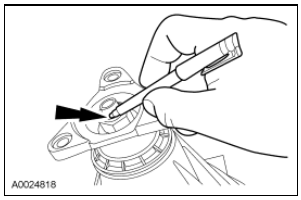


6. ⚠ **CAUTION: After removing the differential drive pinion nut, discard it. Always use a new differential drive pinion nut for installation.**

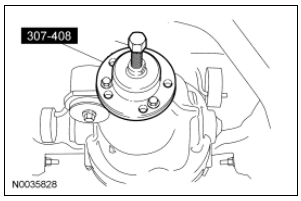
   Use the special tool to hold the rear axle pinion flange while removing the differential drive pinion nut.



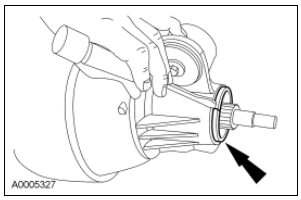
7. Index-mark the rear axle pinion flange and drive pinion gear to maintain initial balance during installation.



8. Using the special tool, remove the rear axle pinion flange.



9. Use a screwdriver to force up the metal flange of the rear axle drive pinion seal. Install gripping pliers and strike with a hammer to remove the rear axle drive pinion seal.

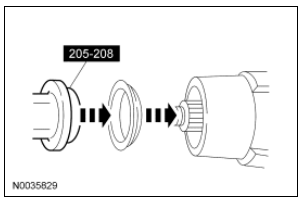


Installation

1. Lubricate the lips of the new rear axle drive pinion seal.
   - Use Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C) meeting Ford specification ESA-M1C75-B.

2. ⚠ **CAUTION: If the rear axle drive pinion seal becomes misaligned during installation, remove the rear axle drive pinion seal and install a new one.**

Using the special tool, install the new rear axle drive pinion seal.



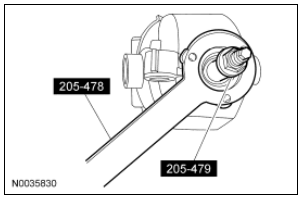
3. Inspect the rear axle pinion flange seal journal for rust, nicks and scratches prior to installing the flange. Polish the rear axle pinion flange seal journal with fine crocus cloth, if necessary.

4. Lubricate the rear axle pinion flange splines.
   - Use Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C) meeting Ford specification ESA-M1C75-B.

5. **NOTE:** Disregard the index marks if installing a new rear axle pinion flange.

   Align the index marks on the rear axle pinion flange and drive pinion gear.

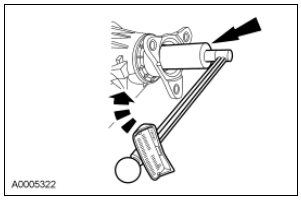
6. Using the special tools, install the rear axle pinion flange.



7. ⚠ **CAUTION: Do not, under any circumstance, loosen the differential drive pinion nut to reduce preload. If it is necessary to reduce preload, install a new differential drive pinion collapsible spacer and differential drive pinion nut.**

   Tighten the differential drive pinion nut to set the preload.

   - Rotate the pinion occasionally to make sure the pinion bearings seat correctly. Take frequent pinion bearing torque preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.
   - If the preload recorded prior to disassembly is lower than the specification for used bearings, tighten the differential drive pinion nut to specification. If the preload recorded prior to disassembly is higher than the specification for used bearings, tighten the differential drive pinion nut to the original reading as recorded.
   - Refer to the torque specification for used pinion bearings in the Specifications portion of this section.



8. Install the rear brake caliper and support bracket.
   - Tighten to 103 Nm (76 lb-ft).

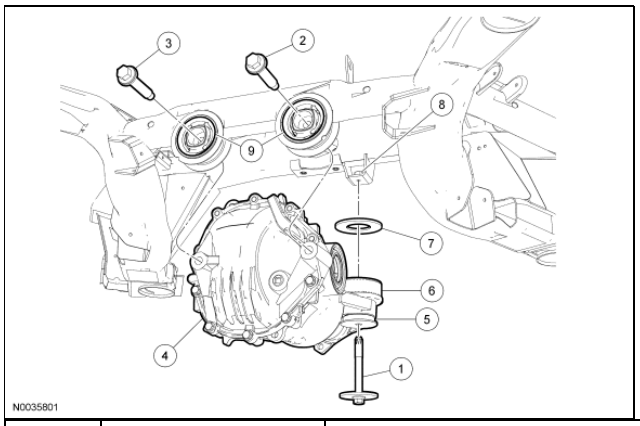
9. Install the driveshaft assembly. For additional information, refer to Section 205-01 .

10. Install the rear wheel and tire assemblies. For additional information, refer to Section 204-04 .

Axle Assembly

Material

Item	Specification
Motorcraft SAE 75W-140 High Performance Rear Axle Lubricant XY-75W-140-QL	WSL-M2C192-A
Threadlock 262 TA-26	WSK-M2G351-A6



Item	Part Number	Description
1	W706464-S426	Rear axle housing support insulator front bolt
2	W701905-S439	Rear axle housing support insulator rear bolt
3	W701905-S439	Rear axle housing support insulator rear bolt
4	4000	Rear axle assembly
5	4B424	Rear axle housing support insulator snubber
6	4B431	Rear axle housing support insulator bushing
7	4067	Shim
8	W520114-S	Rear axle housing support insulator nut
9	4B424	Rear axle housing support insulators

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the rear halfshafts. For additional information, refer to Section 205-05 .

3. **⚠ CAUTION: To make sure assembly is in the exact same location, index-mark the bolt, nut, washer, flex coupling and pinion flange with paint or marker. Using a different color paint or marker, index-mark the second bolt, nut and washer that retain the driveshaft and flex coupling to the pinion flange and the transmission flange. Do not index-mark the third bolt, nut and washer that retain the driveshaft and flex coupling to the pinion flange. These fasteners are balance weights. Always assemble them in their original positions. Failure to do so can cause a driveshaft NVH concern.**

Index-mark the components.

4. **NOTE:** When installing the flex coupling-to-driveshaft bolts and flex coupling-to-driveshaft bolt nuts, coat the flex coupling-to-driveshaft bolts and flex coupling-to-driveshaft bolt nuts threads with Threadlock 262.

   Remove the flex coupling-to-driveshaft bolts and flex coupling-to-driveshaft bolt nuts, then disconnect the driveshaft from the rear axle flange.

   - Using mechanics wire, position aside the driveshaft.
   - To install, tighten to 81 Nm (60 lb-ft).

5. Position a suitable transmission jack under the axle housing. Securely strap the axle housing to the transmission jack.

6. Remove the front rear axle housing support insulator bolt.
   - To install, tighten to 90 Nm (66 lb-ft).

7. Remove the 2 rear axle housing support insulator rear bolts.
   - To install, tighten to 150 Nm (111 lb-ft).

8. Lower the axle from the vehicle.

9. To install, reverse the removal procedure.

10. If necessary, fill the axle.
    - Use High Performance Rear Axle Lubricant to 3-5 mm (1/8-3/16 in) from the bottom of the filler hole.

Rear Axle Housing Support Insulator

Special Tool(s)

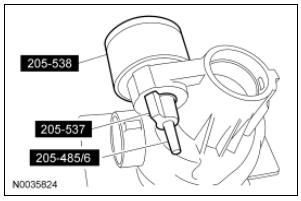
ST2543-A	Remover/Installer, Differential Bushing 205-485 (contains 205-485/1 to 205-485/7)
ST2801-A	Remover, Axle Bushing 205-537
ST1159-A	Remover, Axle Bushing 205-538
ST2269-A	Installer, Front Axle Mounting Bushing (T96T-5638-A) 205-369

Removal

NOTE: The procedure to remove the rear axle housing support insulator from the axle or the frame is the same.

1. Remove the axle assembly. For additional information, refer to Axle Assembly in this section.

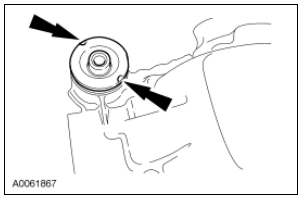
2. Using the special tool, remove the rear axle housing support insulator from the axle.



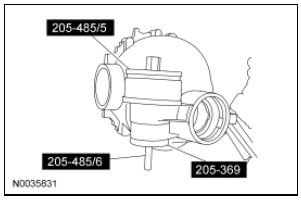
Installation

1. **NOTE:** Install the rear axle housing support insulator into the frame with the rubber legs positioned vertically.

   Insert the rear axle housing support insulator and make sure the notches are aligned 45 degrees from a forward and aft location.



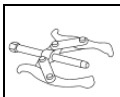
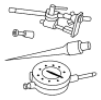
2. Using the special tool, install the rear axle housing support insulator.

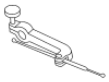


3. Install the axle assembly. For additional information, refer to Axle Assembly in this section.

Differential Ring And Pinion

Special Tool(s)

 ST1220-A	2-Jaw Puller 205-116 (T77F-4220-B1)
ST1743-A	Depth Gauge/Aligner Depth Pinion 205-477
ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
ST1434-A	Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)
ST1743-A	Depth Gauge, Drive Pinion 205-476
ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
ST1367-A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
ST1678-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
ST1725-A	Step Plate 205-D019 (D83T-4205-C2) or equivalent
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)

ST2458-B	Holding Fixture, Drive Pinion Flange 205-478
	Installer, Drive Pinion Flange 205-479
ST2452-A	Remover, Output Flange 307-408
ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1485-A	Installer, Differential Shim 205-220 (T85L-4067-AH)
ST2027-A	Halfshaft Seal Installer 205-539
ST1349-A	Gauge, Differential Bearing 205-540
ST1350-A	Gauge, Differential Bearing 205-541

Material

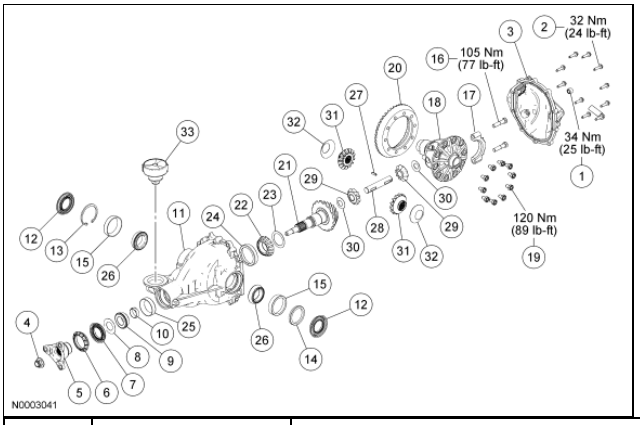
Item	Specification
Premium Long-Life Grease XG-1-C	ESA-M1C75-B
SAE 75W-140 High Performance Rear Axle Lubricant XY-75W140-QL	WSL-M2C192-A
Stud and Bearing Mount TA-27	WSK-M2G349-A1
Silicone Gasket and Sealant F7AZ-19554-EA	WSE-M4G323-A4
Marking Compound	—

Disassembly

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-04 .

2. Remove the rear axle assembly. For additional information, refer to Axle Assembly in this section.

Drain the axle.



Item	Part Number	Description
1	390943-S	Lubricant fill plug
2	390919-S	Differential housing cover bolts
3	4033	Differential housing cover
4	389546-S	Differential drive pinion nut
5	4851	Rear axle pinion flange
6	4859	Rear pinion oil seal deflector
7	4676	Rear pinion oil seal
8	4670	Rear pinion oil seal slinger
9	4621	Outer pinion bearing
10	4662	Drive pinion collapsible spacer
11	4010	Differential housing
12	4B416	Halfshaft housing seal
13	13277	Selective snap ring
14	4067	Differential bearing shim
15	4222	Differential bearing cup
16	46108-S	Bearing cap bolt
17	—	Bearing cap
18	4204	Differential case
19	4982	Differential ring gear bolts
20	4209	Differential ring gear
21	4209	Differential pinion gear
22	4630	Inner pinion bearing
23	4663	Differential pinion bearing adjustment shim
24	4628	Inner pinion bearing cup
25	4616	Outer pinion bearing cup
26	4221	Differential bearing
27	4241	Differential pinion shaft roll pin
28	4211	Differential pinion shaft
29	4215	Differential pinion gear
30	4230	Differential pinion gear thrust washer
31	4236	Differential side gear
32	4228	Differential side gear thrust washer

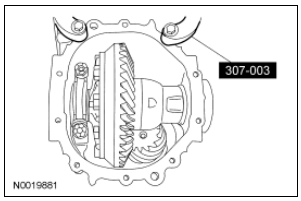
3.

33	4B431	Rear axle housing support insulator

4. ⚠ **CAUTION: The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new Silicone Gasket and Sealant F7AZ-19554-EA meeting Ford specification WSE-M4G323-A4. Cover the inside of the axle before cleaning the machined surface to prevent contamination.**

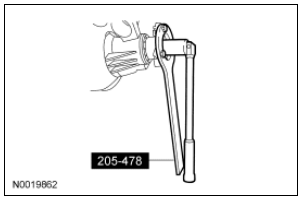
   Remove the differential housing cover.

5. Mount the differential assembly in the special tool.

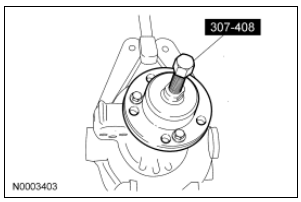


6. ⚠ **CAUTION: After removing the differential drive pinion nut, discard it. Use a new differential drive pinion nut for installation.**

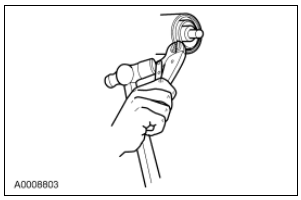
   Use the special tool to hold the rear axle pinion flange while removing the differential drive pinion nut.



7. Using the special tool, remove the rear axle pinion flange.

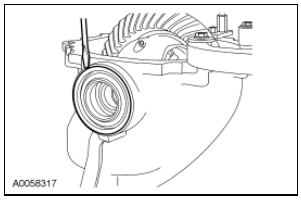


8. Use a screwdriver to force up the metal flange of the rear pinion oil seal. Install gripping pliers and strike with a hammer to remove the rear pinion oil seal.

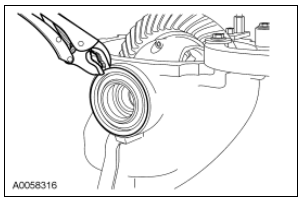


9. Remove the rear pinion oil seal slinger, outer pinion bearing and the drive pinion collapsible spacer.

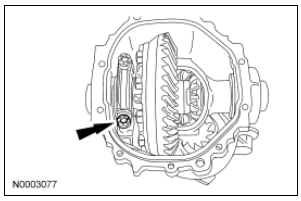
10. Force up the metal flange on the halfshaft housing seals.



11. Install gripping pliers and strike with a hammer to remove the halfshaft housing seals from the housing.



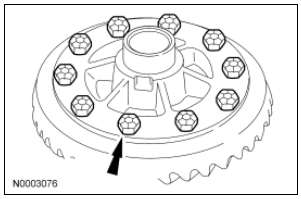
12. Index mark the differential bearing cap, then remove the differential bearing cap bolts and bearing cap.



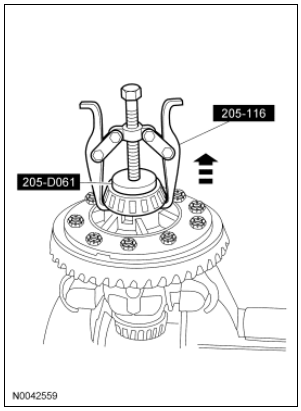
13. Remove the selective snap ring, differential bearing shim and the differential bearing cups.

14. Remove the differential case assembly.

15. Remove the differential ring gear bolts then the differential ring gear.



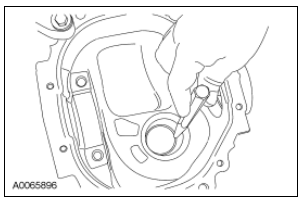
16. Using the special tools, remove the differential bearings.



17. Remove the differential pinion gear.

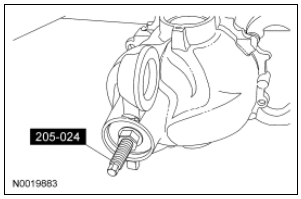
18. Using a drift punch and a hammer, remove the inner pinion bearing cup.

19. Using a drift punch and a hammer, remove the outer pinion bearing cup.



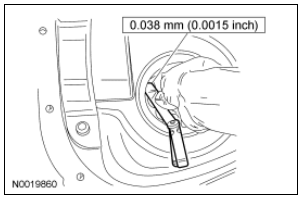
Assembly

1. Using the special tool, install the differential drive pinion bearing cups.
   - Position the bearing cups on the special tool.
   - Position the special tool and the bearing cups in the differential housing.
   - Tighten the special tool to fully seat the bearing cups in the bores.



2. **NOTE:** If a feeler gauge of the specification shown can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not correctly seated.

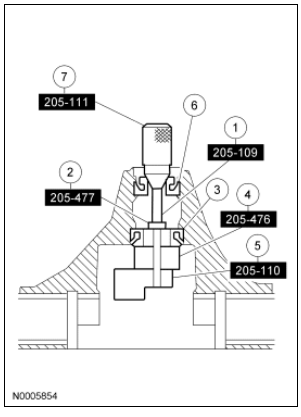
   Make sure the differential pinion bearing cups are correctly seated.



3. ⚠ **CAUTION: Use the same drive pinion bearings and the drive pinion bearing adjustment shim from the drive pinion bearing adjustment shim selection procedure for final assembly.**

   NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the drive pinion bearing preload settings.

   Install the differential pinion bearings and special tools as shown.

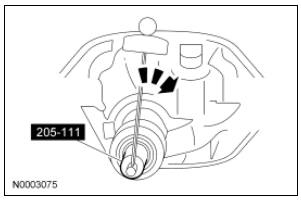


Item	Part Number	Description
1	205-109	Adapter for 205-S127
2	205-477	Depth Gauge/Aligner
3	4630	Rear (inner) pinion bearing
4	205-476	Depth Gauge, Drive Pinion
5	205-110	Adapter for 205-S127
6	4621	Front (outer) pinion bearing
7	205-111	Adapter for 205-S127

4. **NOTE:** This step duplicates differential pinion bearing preload.

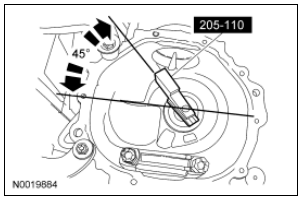
   Thread the special tool onto the screw.

   - Tighten to 2.2 Nm (20 lb-in) rotational torque.

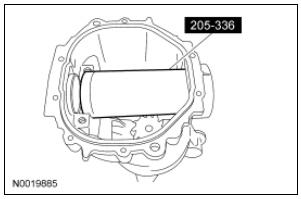


5. ⚠ **CAUTION: Offset the special tool to obtain an accurate reading.**

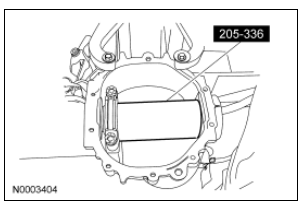
   Rotate the special tool several half turns to seat the differential pinion bearings. Position the special tool as shown.



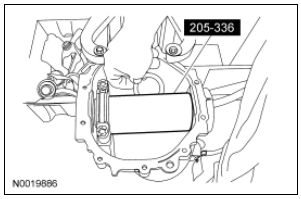
6. Install the special tool.
   - Position the special tool in the differential housing differential bearing seat.



7. Install the differential bearing cap, then install the differential bearing cap bolts.
   - Tighten to 105 Nm (77 lb-ft).



8. Use a differential pinion bearing adjustment shim as a gauge for shim selection. Check the differential pinion bearing adjustment shim thickness between the Gauge Block and the Gauge Tube. A slight drag indicates correct differential pinion bearing adjustment shim selection.

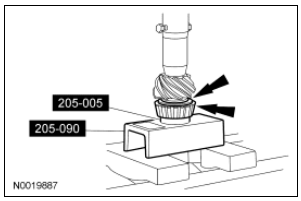


9. Remove all of the special tools.

10. ⚠ **CAUTION: Use the same differential pinion bearings and differential pinion bearing adjustment shim from the differential pinion bearing adjustment shim selection procedure for final assembly.**

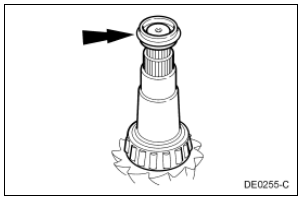
    Position the differential pinion bearing adjustment shim and the inner pinion bearing on the differential pinion stem.

11. Using the special tools and a suitable press, firmly seat the differential pinion bearing adjustment shim and inner pinion bearing on the differential pinion stem.



12. ⚠ **CAUTION: Make sure the splines on the differential pinion stem are free of burrs. If burrs are evident, remove them using a fine crocus cloth.**

    Place a new drive pinion collapsible spacer on the differential pinion stem against the differential pinion stem shoulder.



13. Install the differential pinion gear with the drive pinion collapsible spacer in the differential housing.

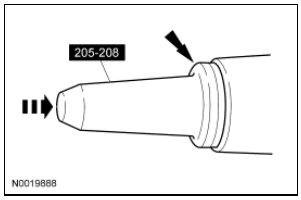
14. Install the outer pinion bearing and rear pinion oil seal slinger.

15. ⚠ **CAUTION: Installation without the correct tool can result in early rear pinion oil seal failure.**

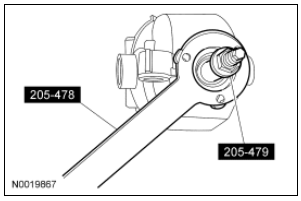
    ⚠ **CAUTION: If the rear pinion oil seal becomes misaligned during installation, remove it and install a new one.**

    NOTE: Coat the rear pinion oil seal lips with grease.

    Using the special tool, install the new rear pinion oil seal.



16. Using the special tools, install the rear axle pinion flange.

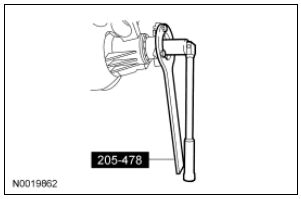


17. ⚠ **CAUTION: Do not, under any circumstance, loosen the differential drive pinion nut to reduce differential pinion bearing preload. If it is necessary to reduce differential pinion bearing preload, install a new drive pinion collapsible spacer and differential drive pinion nut.**

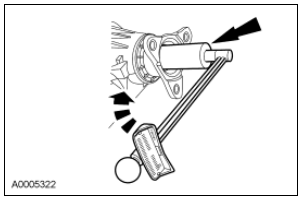
    ⚠ **CAUTION: Remove the special tool while taking differential pinion bearing preload readings with the Nm (lb-in) torque wrench.**

    Use the special tool to hold the rear axle pinion flange while tightening the differential drive pinion nut.

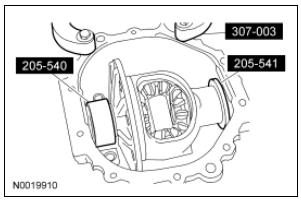
    - Rotate the differential pinion gear occasionally to make sure the differential pinion bearings seat correctly. Take frequent differential pinion bearing preload readings by rotating the differential pinion gear with a Nm (lb-in) torque wrench.



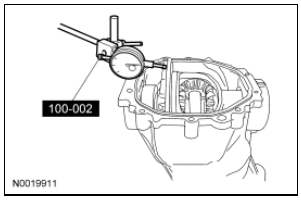
18. Tighten the differential drive pinion nut to set the differential pinion bearing preload.



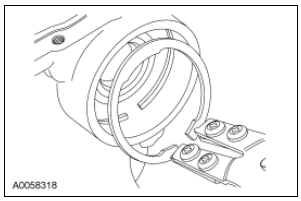
19. Install the special tools on the differential case.



20. Position the special tool on the differential case in the differential housing.



21. Install a unique set-up selective snap ring with a thickness of 2.54 mm (0.100 in).
    - The selective snap ring is available from the Ford dealer parts department.



22. **NOTE:** Repeat this step until obtaining a consistent reading.

    Measure the total end play.

    - Attach the special tools and position the indicator tip on the machined surface of the differential case flange.
    - Move the differential case to the left and the right (as far as possible).
    - Record the reading in Line A.

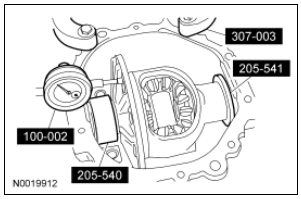
Differential Bearing Shim Selection Chart

8.0 Inch Lightweight Axle	Example	Actual
Line A Total end play without ring gear	0.230	
Line B Total end play with ring gear	0.193	
Line C Subtract Line B from Line A	0.037	
Line D Initial backlash clearance	0.016	0.016
Line E Set-up snap ring thickness	0.100	0.100
Line F Left Master Bearing compensation	0.100	0.100
Line G Carrier bearing preload	0.012	0.012

To determine the snap ring thickness, add lines C, D and E (Example: 0.037 + 0.016 + 0.100 = 0.153 snap ring thickness).

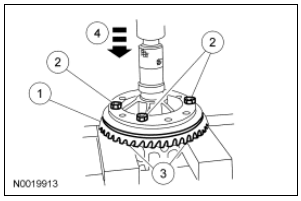
To determine the bearing shim thickness, add lines A, F and G. Subtract line C and D from the sum. Example:

- 0.230 + 0.100 + 0.012 = 0.342
- 0.342 - 0.037 - 0.016 = 0.289 bearing shim thickness

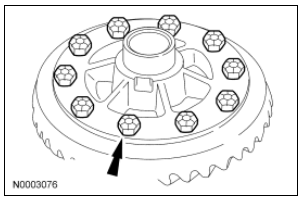


23. Remove the dial indicator and the differential case from the differential housing.

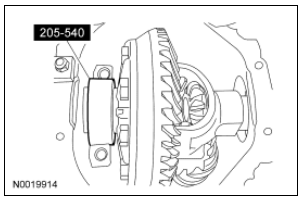
24. Install the differential ring gear.
    1. Place the differential ring gear on the differential case.
    2. Hand start 3 differential ring gear bolts to align the holes in the differential ring gear and the differential case.
    3. Place the differential case and differential ring gear onto the press bed blocks with the differential ring gear teeth facing downward.
    4. Press the differential ring gear into place.



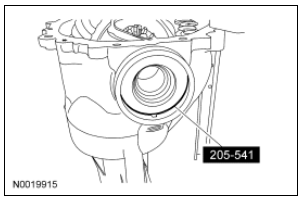
25. Install the remaining differential ring gear bolts. Apply sealer to the ring gear bolt threads.
    - Tighten to 120 Nm (89 lb-ft).



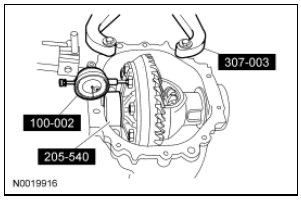
26. Place the differential case with the special tool into the differential housing.



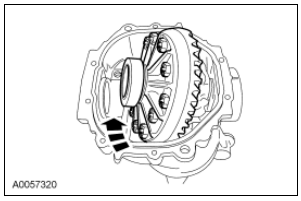
27. Install the special tool.



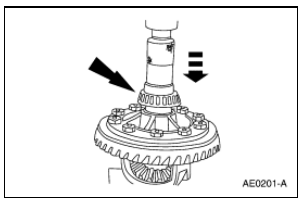
28. Measure the end play.
    - Attach the special tool and position the indicator tip on the machined surface of the differential case flange.
    - Rock the differential ring gear to allow full mesh with the drive pinion gear.
    - With the gears in full mesh, set the special tool to zero.
    - Move the differential case as far as possible to the left and note the reading.
    - Record the reading on the differential bearing shim selection procedure Line B.
        - ♦ Remove the special tool.



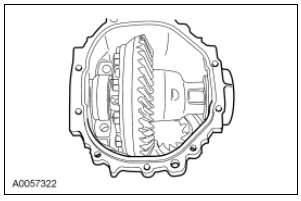
29. Remove the differential case from the differential housing.



30. Using a suitable press, press the differential bearings on the differential case.



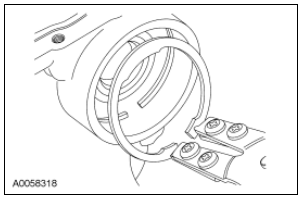
31. Place the differential case and differential bearing cups in the differential case.



32. **NOTE:** Select the correct size selective snap ring using the differential bearing shim selection chart.

    NOTE: To determine the thickness of the selective snap ring to be used, subtract Line B from Line A. Add Lines D and E to the difference. This is the thickness of the selective snap ring required.

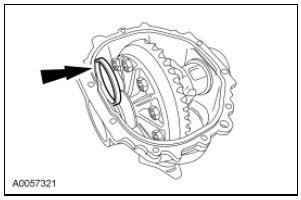
    Place the selective snap ring in the differential housing.



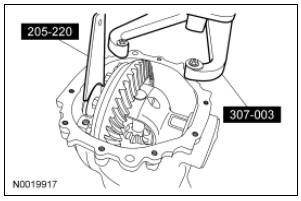
33. **NOTE:** Select the correct size selective bearing shim using the differential bearing shim selection chart.

    NOTE: To determine the thickness of the differential bearing shim to be used, add Lines A, F and G. Subtract Lines C and D from the sum. This is the thickness of the differential bearing shim required.

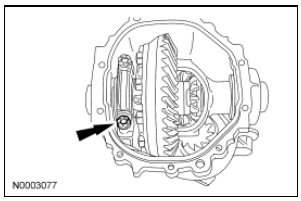
    Position the differential bearing shim indicated by the differential bearing shim selection chart.



34. Using the special tools, seat the differential bearing shim in the differential housing.

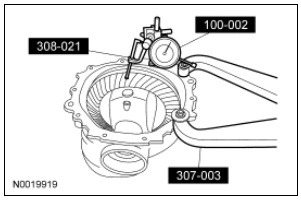


35. Install the differential bearing cap, then the differential bearing cap bolts in the original location.
    - Tighten to 105 Nm (77 lb-ft).



36. Lubricate the lips of the halfshaft housing seal with grease.

37. Using the special tools, measure the differential ring gear backlash at 4 equally spaced points.
    - Attach the special tool.
    - Position the special tool tip centrally on a drive tooth.
    - Zero the indicator.
    - Turn the differential ring gear without turning the differential pinion gear. Record the indicator reading. The allowable backlash is 0.127 mm (0.005 in) to 0.228 mm (0.009 in) and must not vary more than 0.076 mm (0.003 in) between points measured. A backlash variation of more than 0.076 mm (0.003 in) between points checked indicates gear/case runout.
        - ♦ If backlash is within specifications, install the axle assembly.
        - ♦ To correct for a high or low backlash, proceed as follows.



38. To correct for high or low backlash, increase or decrease the thickness of the differential bearing shim and decrease or increase the thickness of the selective snap ring by the same amount. Refer to the following tables when adjusting the backlash. When the backlash is within specifications, install the differential assembly.

Backlash Change Required		Thickness Change Required	
mm	**in**	**mm**	**in**
0.025	0.001	0.050	0.002

0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Snap Ring Size Chart — 13277 —

Numbers of Stripes and Color Code	Dimension A	
	mm	in
1 YEL	3.15	0.1240
2 YEL	3.17	0.1248
3 YEL	3.19	0.1256
4 YEL	3.21	0.1264
5 YEL	3.23	0.1272
1 WH	3.25	0.1280
2 WH	3.27	0.1287
3 WH	3.29	0.1295
4 WH	3.31	0.1303
5 WH	3.33	0.1311
1 GRN	3.35	0.1319
2 GRN	3.37	0.1327
3 GRN	3.39	0.1335
4 GRN	3.41	0.1343
5 GRN	3.43	0.1350
1 PINK	3.45	0.1358
2 PINK	3.47	0.1366
3 PINK	3.49	0.1374
4 PINK	3.51	0.1382
5 PINK	3.53	0.1390
1 BLU	3.55	0.1398
2 BLU	3.57	0.1406

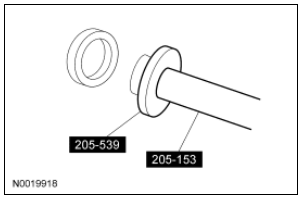
3 BLU	3.59	0.1413
4 BLU	3.61	0.1421
5 BLU	3.63	0.1429
1 BLK	3.65	0.1437
2 BLK	3.67	0.1445
3 BLK	3.69	0.1453
4 BLK	3.71	0.1461
5 BLK	3.73	0.1469
1 BROWN	3.75	0.1476
2 BROWN	3.77	0.1484
3 BROWN	3.79	0.1492
4 BROWN	3.81	0.1500
5 BROWN	3.83	0.1508
1 YEL/1 BLK	3.85	0.1516
2 YEL/1 BLK	3.87	0.1524
3 YEL/1 BLK	3.89	0.1531
4 YEL/1 BLK	3.91	0.1539
5 YEL/1 BLK	3.93	0.1547
1 WH/1 BLK	3.95	0.1555
2 WH/1 BLK	3.97	0.1563
3 WH/1 BLK	3.99	0.1571
4 WH/1 BLK	4.01	0.1579
5 WH/1 BLK	4.03	0.1587
1 GRN/1 BLK	4.05	0.1594
2 GRN/1 BLK	4.07	0.1602
3 GRN/1 BLK	4.09	0.1610
4 GRN/1 BLK	4.11	0.1618
5 GRN/1 BLK	4.13	0.1626
1 PINK/1 BLK	4.15	0.1634
2 PINK/1 BLK	4.17	0.1642
3 PINK/1 BLK	4.19	0.1650
4 PINK/1 BLK	4.21	0.1657
5 PINK/1 BLK	4.23	0.1665

Differential Shim Size Chart — 4067 —

Numbers of Stripes and Color Code	Dimension A	
	mm	in
2 — C-COAL	7.7978- 7.8105	0.3070- 0.3075
1 — C-COAL	7.7470- 7.7597	0.3050- 0.3055
5 — BLU	7.6962- 7.7089	0.3030- 0.3035
4 — BLU	7.6454- 7.6581	0.3010- 0.3015

3 — BLU	7.5946- 7.6073	0.2990- 0.2995
2 — BLU	7.5458- 7.5565	0.2970- 0.2975
1 — BLU	7.493- 7.505	0.2950- 0.2955
5 — PINK	7.4422- 7.4549	0.2930- 0.2935
4 — PINK	7.3914- 7.4041	0.2910- 0.2915
3 — PINK	7.3406- 7.3533	0.2890- 0.2895
2 — PINK	7.2898- 7.3025	0.2870- 0.2875
1 — PINK	7.2390- 7.2517	0.2850- 0.2855
5 — GRN	7.1882- 7.2009	0.2830- 0.2835
4 — GRN	7.1374- 7.1501	0.2810- 0.2815
3 — GRN	7.0866- 7.0993	0.2790- 0.2795
2 — GRN	7.0358- 7.0485	0.2770- 0.2775
1 — GRN	6.9850- 7.0485	0.2750- 0.2755
5 — WH	6.9342- 6.9469	0.2730- 0.2735
4 — WH	6.8834- 6.8961	0.2710- 0.2715
3 — WH	6.8326- 6.8453	0.2690- 0.2695
2 — WH	6.7818- 6.7945	0.2670- 0.2675
1 — WH	6.7310- 6.7437	0.2650- 0.2655
5 — YEL	6.6802- 6.6929	0.2630- 0.2635
4 — YEL	6.6294- 6.6421	0.2610- 0.2615
3 — YEL	6.5786- 6.5913	0.2590- 0.2595
2 — YEL	6.5278- 6.5405	0.2570- 0.2575
1 — YEL	6.4770- 6.4897	0.2550- 0.2555
5 — ORNG	6.4262- 6.4389	0.2530- 0.2535
4 — ORNG	6.3754- 6.3881	0.2510- 0.2515
3 — ORNG	6.3246- 6.3373	0.2490- 0.2495
2 — ORNG	6.2738- 6.2865	0.2470- 0.2475
1 — ORNG	6.2223- 6.2357	0.2450- 0.2455
2 — RED	6.1722- 6.1849	0.2430- 0.2435
1 — RED	6.1214- 6.1341	0.2410- 0.2415

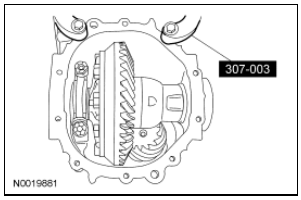
39. Using the special tools, install the halfshaft housing seal.



40. Apply marking compound and rotate the differential assembly 5 complete revolutions.

41. Verify an acceptable pattern check. For additional information, refer to Diagnosis and Testing in this section.

42. Remove the differential assembly from the special tool.



43. ⚠ **CAUTION: The differential housing cover must be installed within 15 minutes of application of the sealant.**

    ⚠ **CAUTION: Allow the Silicone Gasket and Sealant to cure for 1 hour before filling the axle with lubricant.**

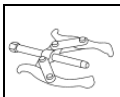
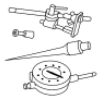
    Apply a continuous bead of Silicone Gasket and Sealant to the differential housing cover mounting surface, then install the differential housing cover.

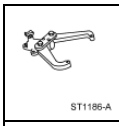
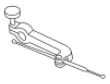
44. Install the rear axle assembly. For additional information, refer to Axle Assembly in this section.

45. Fill the axle with the specified amount of specified lubricant.

Differential Bearings

Special Tool(s)

 ST1220-A	2-Jaw Puller 205-116 (T77F-4220-B1)
ST1743-A	Depth Gauge/Aligner Depth Pinion 205-477
ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
ST1434-A	Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)
ST1743-A	Depth Gauge, Drive Pinion 205-476
ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
ST1367-A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
ST1678-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
ST1725-A	Step Plate 205-D061 (D83T-4205-C2) or equivalent
ST1310-A	Remover, Bearing 205-055 (T71P-4621-B)

 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
ST2458-B	Holding Fixture, Drive Pinion Flange 205-478
	Installer, Drive Pinion Flange 205-479
ST2452-A	Remover, Output Flange 307-408
ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1485-A	Installer, Differential Shim 205-220 (T85L-4067-AH)
ST2027-A	Halfshaft Seal Installer 205-539
ST1349-A	Gauge, Differential Bearing 205-540
ST1350-A	Gauge, Differential Bearing 205-541

Material

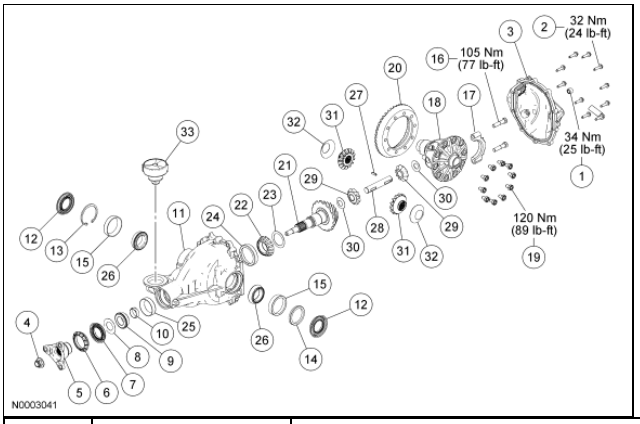
Item	Specification
Premium Long-Life Grease XG-1-C	ESA-M1C75-B
SAE 75W-140 High Performance Rear Axle Lubricant XY-75W140-QL	WSL-M2C192-A
Stud and Bearing Mount TA-27	WSK-M2G349-A1
Silicone Gasket and Sealant F7AZ-19554-EA	WSE-M4G323-A4
Marking Compound	—

Disassembly

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-04 .

2. Remove the rear axle assembly. For additional information, refer to Axle Assembly in this section.

3. Drain the axle lubricant.



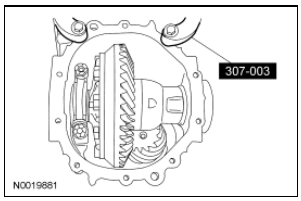
Item	Part Number	Description
1	390943-S	Lubricant fill plug
2	390919-S	Differential housing cover bolts
3	4033	Differential housing cover
4	389546-S	Differential drive pinion nut
5	4851	Rear axle pinion flange
6	4859	Rear pinion oil seal deflector
7	4676	Rear pinion oil seal
8	4670	Rear pinion oil seal slinger
9	4621	Outer pinion bearing
10	4662	Drive pinion collapsible spacer
11	4010	Differential housing
12	4B416	Halfshaft housing seal
13	13277	Selective snap ring
14	4067	Differential bearing shim
15	4222	Differential bearing cup
16	46108-S	Bearing cap bolt
17	—	Bearing cap
18	4204	Differential case
19	4982	Differential ring gear bolts
20	4209	Differential ring gear
21	4209	Differential pinion gear
22	4630	Inner pinion bearing
23	4663	Differential pinion bearing adjustment shim
24	4628	Inner pinion bearing cup
25	4616	Outer pinion bearing cup
26	4221	Differential bearing
27	4241	Differential pinion shaft roll pin
28	4211	Differential pinion shaft

29	4215	Differential pinion gear
30	4230	Differential pinion gear thrust washer
31	4236	Differential side gear
32	4228	Differential side gear thrust washer
33	4B431	Rear axle housing support insulator

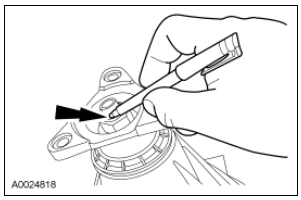
4. ⚠ **CAUTION: The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new Silicone Gasket and Sealant F7AZ-19554-EA meeting Ford specification WSE-M4G323-A4. Cover the inside of the axle before cleaning the machined surface to prevent contamination.**

   Remove the differential housing cover.

5. Mount the differential assembly in the special tool.

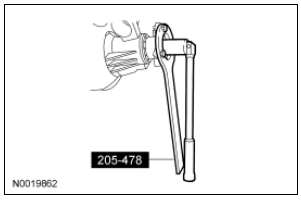


6. Index-mark the rear axle pinion flange to the differential pinion stem.

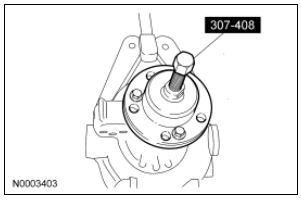


7. ⚠ **CAUTION: After removing the differential drive pinion nut, discard it. Use a new differential drive pinion nut for installation.**

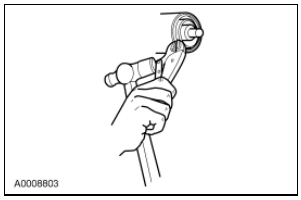
   Use the special tool to hold the rear axle pinion flange while removing the differential drive pinion nut.



8. Using the special tool, remove the rear axle pinion flange.

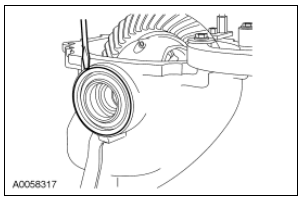


9. Use a screwdriver to force up the metal flange of the rear pinion oil seal. Install gripping pliers and strike with a hammer to remove the rear pinion oil seal.

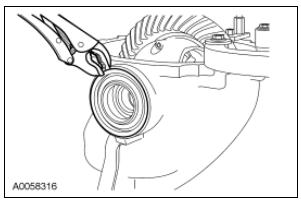


10. Remove the rear pinion oil seal slinger, outer pinion bearing and the drive pinion collapsible spacer.

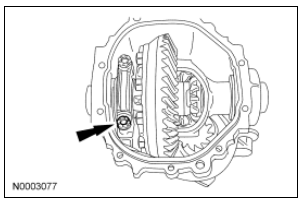
11. Force up the metal flange on the halfshaft housing seal.



12. Install gripping pliers and strike with a hammer to remove the halfshaft housing seals from the housing.



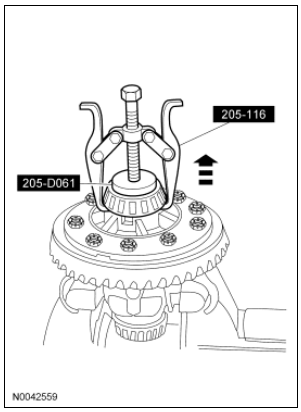
13. Remove the differential bearing cap bolts and bearing cap after index-marking the original location.



14. Remove the selective snap ring, differential bearing shim and the differential bearing cups.

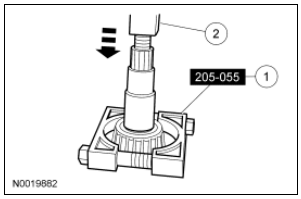
15. Remove the differential case assembly.

16. Using the special tools, remove the differential bearings.



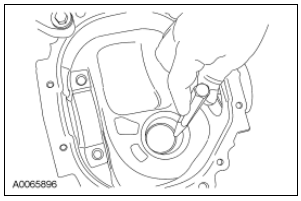
17. Remove the differential pinion gear.

18. Using the special tool and a suitable press, remove the inner pinion bearing.
    1. Position the special tool under the inner pinion bearing.
    2. Press the inner pinion bearing off the differential pinion gear.



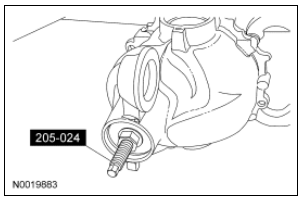
19. Using a drift punch and a hammer, remove the inner pinion bearing cup.

20. Using a drift punch and a hammer, remove the outer pinion bearing cup.



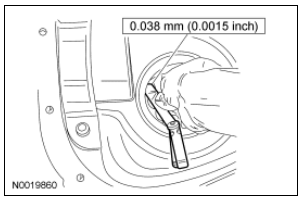
Assembly

1. Using the special tool, install the differential drive pinion bearing cups.
    - Position the bearing cups on the special tool.
    - Position the special tool and the bearing cups in the differential housing.
    - Tighten the special tool to fully seat the bearing cups in the bores.



2. **NOTE:** If a feeler gauge of the specification shown can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not correctly seated.

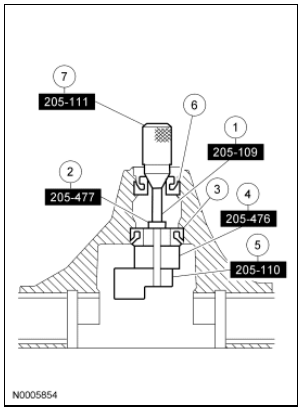
   Make sure the differential pinion bearing cups are correctly seated.



3. ⚠ **CAUTION: Use the same drive pinion bearings and the drive pinion bearing adjustment shim from the drive pinion bearing adjustment shim selection procedure for final assembly.**

   NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the drive pinion bearing preload settings.

   Install the differential pinion bearings and special tools as shown.

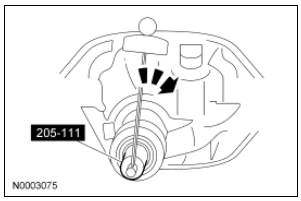


Item	Part Number	Description
1	205-109	Adapter for 205-S127
2	205-477	Depth Gauge/Aligner
3	4630	Rear (inner) pinion bearing
4	205-476	Depth Gauge, Drive Pinion
5	205-110	Adapter for 205-S127
6	4621	Front (outer) pinion bearing
7	205-111	Adapter for 205-S127

4. **NOTE:** This step duplicates differential pinion bearing preload.

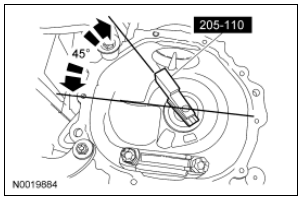
   Thread the special tool onto the screw.

   - Tighten to 2.2 Nm (20 lb-in).

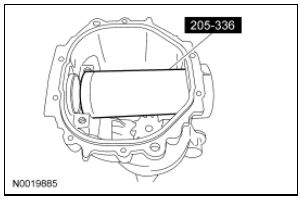


5. ⚠ **CAUTION: Offset the special tool to obtain an accurate reading.**

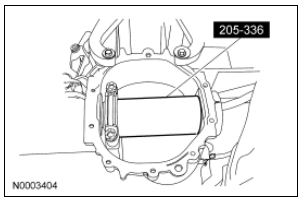
   Rotate the special tool several half turns to seat the differential pinion bearings. Position the special tool as shown.



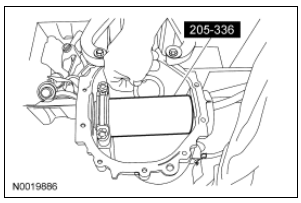
6. Install the special tool.
   - Position the special tool in the differential housing differential bearing seat.



7. Install the differential bearing cap, then install the differential bearing cap bolts.
   - Tighten to 105 Nm (77 lb-ft).



8. Use a differential pinion bearing adjustment shim as a gauge for shim selection. Check the differential pinion bearing adjustment shim thickness between the Gauge Block and the Gauge Tube. A slight drag indicates correct differential pinion bearing adjustment shim selection.

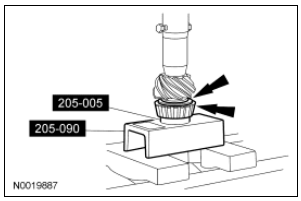


9. Remove all of the special tools.

10. ⚠ **CAUTION: Use the same differential pinion bearings and differential pinion bearing adjustment shim from the differential pinion bearing adjustment shim selection procedure for final assembly.**

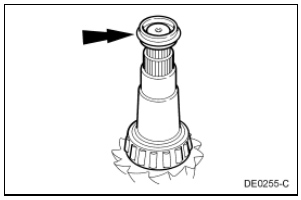
    Position the differential pinion bearing adjustment shim and the inner pinion bearing on the differential pinion stem.

11. Using the special tools and a suitable press, firmly seat the differential pinion bearing adjustment shim and inner pinion bearing on the differential pinion stem.



12. ⚠ **CAUTION: Make sure the splines on the differential pinion stem are free of burrs. If burrs are evident, remove them using a fine crocus cloth.**

    Place a new drive pinion collapsible spacer on the differential pinion stem against the differential pinion stem shoulder.



13. Install the differential pinion gear with the drive pinion collapsible spacer in the differential housing.

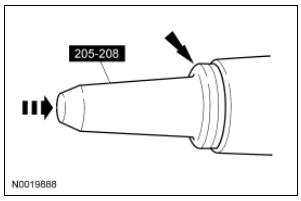
14. Install the outer pinion bearing and rear pinion oil seal slinger.

15. **⚠ CAUTION: Installation without the correct tool can result in early rear pinion oil seal failure.**

    ⚠ CAUTION: If the rear pinion oil seal becomes misaligned during installation, remove it and install a new one.

    NOTE: Coat the rear pinion oil seal lips with grease.

    Using the special tool, install the new rear pinion oil seal.

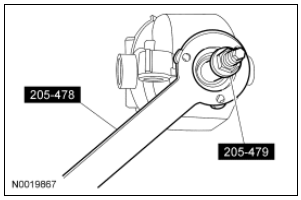


16. **NOTE:** Disregard the index marks if installing a new rear axle pinion flange.

    Position the rear axle pinion flange.

    - Lubricate the rear axle pinion flange splines with grease.

17. Using the special tools, install the rear axle pinion flange.

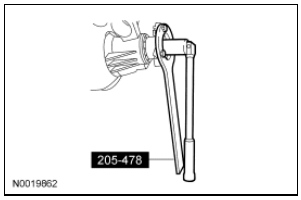


18. **⚠ CAUTION: Do not, under any circumstance, loosen the differential drive pinion nut to reduce differential pinion bearing preload. If it is necessary to reduce differential pinion bearing preload, install a new drive pinion collapsible spacer and differential drive pinion nut.**

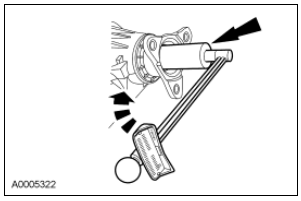
    ⚠ CAUTION: Remove the special tool while taking differential pinion bearing preload readings with the Nm (lb-in) torque wrench.

    Use the special tool to hold the rear axle pinion flange while tightening the differential drive pinion nut.

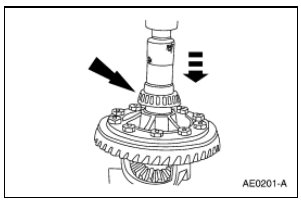
    - Rotate the differential pinion gear occasionally to make sure the differential pinion bearings seat correctly. Take frequent differential pinion bearing preload readings by rotating the differential pinion gear with a Nm (lb-in) torque wrench.



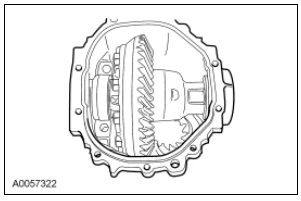
19. Tighten the differential drive pinion nut to set the differential pinion bearing preload.



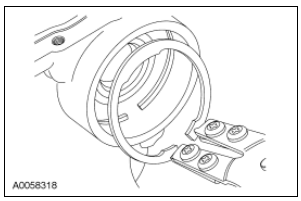
20. Using a suitable press, press the differential bearings on the differential case.



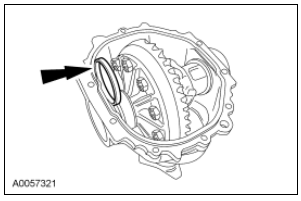
21. Place the differential case and differential bearing cups in the differential case.



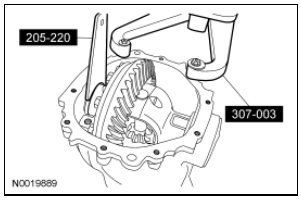
22. Place the original selective snap ring in the differential housing.



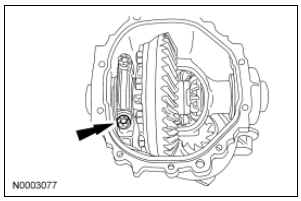
23. Position the original differential bearing shim.



24. Using the special tools, seat the differential bearing shim in the differential housing.

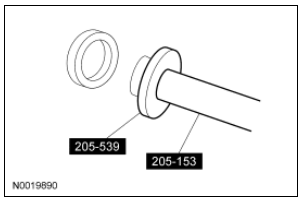


25. Install the differential bearing cap, then the differential bearing cap bolts in their original locations.
    - Tighten to 105 Nm (77 lb-ft).

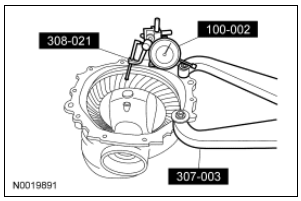


26. Lubricate the lips of the halfshaft housing seal.
    - Use Premium Long-Life Grease XG-1-C meeting Ford specification ESA-M1C75-B.

27. Using the special tools, install the halfshaft housing seal.



28. Using the special tools, measure the differential ring gear backlash at 4 equally spaced points.
    - Attach the special tool.
    - Position the special tool tip centrally on a drive tooth.
    - Zero the indicator.
    - Turn the differential ring gear without turning the differential pinion gear. Record the indicator reading. The allowable backlash is 0.127 mm (0.005 in) to 0.228 mm (0.009 in) and must not vary more than 0.076 mm (0.003 in) between points measured. A backlash variation of more than 0.076 mm (0.003 in) between points checked indicates gear/case runout.
        - ♦ If backlash is within specifications, install the axle assembly.
        - ♦ To correct for a high or low backlash, proceed as follows.



29. To correct for high or low backlash, increase or decrease the thickness of the differential bearing shim and decrease or increase the thickness of the selective snap ring by the same amount. Refer to the following tables when adjusting the backlash. When the backlash is within specifications, install the differential assembly.

Backlash Change Required		Thickness Change Required	
mm	in	mm	in

0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Snap Ring Size Chart — 13277 —

Numbers of Stripes and Color Code	Dimension A	
	mm	in
1 YEL	3.15	0.1240
2 YEL	3.17	0.1248
3 YEL	3.19	0.1256
4 YEL	3.21	0.1264
5 YEL	3.23	0.1272
1 WH	3.25	0.1280
2 WH	3.27	0.1287
3 WH	3.29	0.1295
4 WH	3.31	0.1303
5 WH	3.33	0.1311
1 GRN	3.35	0.1319
2 GRN	3.37	0.1327
3 GRN	3.39	0.1335
4 GRN	3.41	0.1343
5 GRN	3.43	0.1350
1 PINK	3.45	0.1358
2 PINK	3.47	0.1366
3 PINK	3.49	0.1374
4 PINK	3.51	0.1382
5 PINK	3.53	0.1390
1 BLU	3.55	0.1398

2 BLU	3.57	0.1406
3 BLU	3.59	0.1413
4 BLU	3.61	0.1421
5 BLU	3.63	0.1429
1 BLK	3.65	0.1437
2 BLK	3.67	0.1445
3 BLK	3.69	0.1453
4 BLK	3.71	0.1461
5 BLK	3.73	0.1469
1 BROWN	3.75	0.1476
2 BROWN	3.77	0.1484
3 BROWN	3.79	0.1492
4 BROWN	3.81	0.1500
5 BROWN	3.83	0.1508
1 YEL/1 BLK	3.85	0.1516
2 YEL/1 BLK	3.87	0.1524
3 YEL/1 BLK	3.89	0.1531
4 YEL/1 BLK	3.91	0.1539
5 YEL/1 BLK	3.93	0.1547
1 WH/1 BLK	3.95	0.1555
2 WH/1 BLK	3.97	0.1563
3 WH/1 BLK	3.99	0.1571
4 WH/1 BLK	4.01	0.1579
5 WH/1 BLK	4.03	0.1587
1 GRN/1 BLK	4.05	0.1594
2 GRN/1 BLK	4.07	0.1602
3 GRN/1 BLK	4.09	0.1610
4 GRN/1 BLK	4.11	0.1618
5 GRN/1 BLK	4.13	0.1626
1 PINK/1 BLK	4.15	0.1634
2 PINK/1 BLK	4.17	0.1642
3 PINK/1 BLK	4.19	0.1650
4 PINK/1 BLK	4.21	0.1657
5 PINK/1 BLK	4.23	0.1665

Differential Shim Size Chart — 4067 —

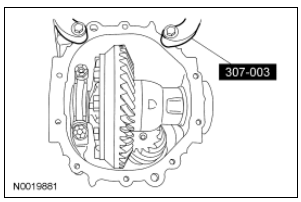
Numbers of Stripes and Color Code	Dimension A	
	mm	in
2 — C-COAL	7.7978- 7.8105	0.3070- 0.3075
1 — C-COAL	7.7470- 7.7597	0.3050- 0.3055
5 — BLU	7.6962- 7.7089	0.3030- 0.3035

4 — BLU	7.6454- 7.6581	0.3010- 0.3015
3 — BLU	7.5946- 7.6073	0.2990- 0.2995
2 — BLU	7.5458- 7.5565	0.2970- 0.2975
1 — BLU	7.493- 7.505	0.2950- 0.2955
5 — PINK	7.4422- 7.4549	0.2930- 0.2935
4 — PINK	7.3914- 7.4041	0.2910- 0.2915
3 — PINK	7.3406- 7.3533	0.2890- 0.2895
2 — PINK	7.2898- 7.3025	0.2870- 0.2875
1 — PINK	7.2390- 7.2517	0.2850- 0.2855
5 — GRN	7.1882- 7.2009	0.2830- 0.2835
4 — GRN	7.1374- 7.1501	0.2810- 0.2815
3 — GRN	7.0866- 7.0993	0.2790- 0.2795
2 — GRN	7.0358- 7.0485	0.2770- 0.2775
1 — GRN	6.9850- 7.0485	0.2750- 0.2755
5 — WH	6.9342- 6.9469	0.2730- 0.2735
4 — WH	6.8834- 6.8961	0.2710- 0.2715
3 — WH	6.8326- 6.8453	0.2690- 0.2695
2 — WH	6.7818- 6.7945	0.2670- 0.2675
1 — WH	6.7310- 6.7437	0.2650- 0.2655
5 — YEL	6.6802- 6.6929	0.2630- 0.2635
4 — YEL	6.6294- 6.6421	0.2610- 0.2615
3 — YEL	6.5786- 6.5913	0.2590- 0.2595
2 — YEL	6.5278- 6.5405	0.2570- 0.2575
1 — YEL	6.4770- 6.4897	0.2550- 0.2555
5 — ORNG	6.4262- 6.4389	0.2530- 0.2535
4 — ORNG	6.3754- 6.3881	0.2510- 0.2515
3 — ORNG	6.3246- 6.3373	0.2490- 0.2495
2 — ORNG	6.2738- 6.2865	0.2470- 0.2475
1 — ORNG	6.2223- 6.2357	0.2450- 0.2455
2 — RED	6.1722- 6.1849	0.2430- 0.2435
1 — RED	6.1214- 6.1341	0.2410- 0.2415

30. Apply marking compound and rotate the differential assembly 5 complete revolutions.

31. Verify an acceptable pattern check. For additional information, refer to Section 205-00.

32. Remove the differential assembly from the special tool.



33. ⚠ **CAUTION: The differential housing cover must be installed within 15 minutes of application**

of the Silicone Gasket and Sealant F7AZ-19554-EA meeting Ford specification WSE-M4G323-A4.

⚠ CAUTION: Allow the Silicone Gasket and Sealant to cure for 1 hour before filling the axle with lubricant.

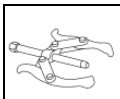
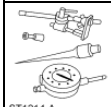
Apply a continuous bead of Silicone Gasket and Sealant to the differential housing cover mounting surface, then install the differential housing cover.

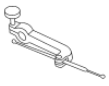
34. Fill the axle with the specified amount of the specified lubricant.

35. Install the rear axle assembly. For additional information, refer to Axle Assembly in this section.

Axle Assembly

Special Tool(s)

 ST1220-A	2-Jaw Puller 205-116 (T77F-4220-B1)
ST1743-A	Depth Gauge/Aligner Depth Pinion 205-477
ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
ST1434-A	Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)
ST1743-A	Depth Gauge, Drive Pinion 205-476
ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
ST1367-A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
ST1678-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
ST1725-A	Step Plate 205-D061 (D83T-4205-C2) or equivalent
ST1310-A	Remover, Bearing 205-055 (T71P-4621-B)

ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
ST2458-B	Holding Fixture, Drive Pinion Flange 205-478
	Installer, Drive Pinion Flange 205-479
ST2452-A	Remover, Output Flange 307-408
ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1485-A	Installer, Differential Shim 205-220 (T85L-4067-AH)
ST2027-A	Halfshaft Seal Installer 205-539
ST1349-A	Gauge, Differential Bearing 205-540
ST1350-A	Gauge, Differential Bearing 205-541

Material

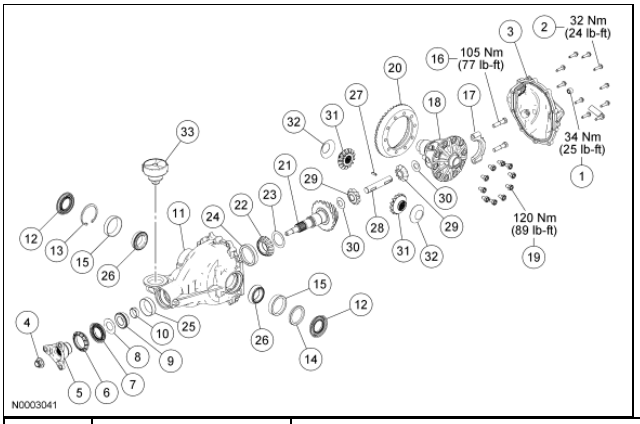
Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B
Motorcraft SAE 75W-140 High Performance Rear Axle Lubricant XY-75W-140-QL	WSL-M2C192-A
Stud and Bearing Mount TA-27	WSK-M2G349-A1
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Disassembly

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the rear axle assembly. For additional information, refer to Axle Assembly in this section.

3. Drain the axle.



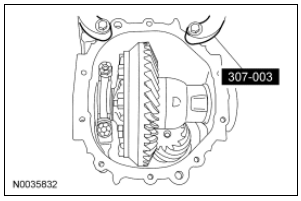
Item	Part Number	Description
1	390943-S	Lubricant fill plug
2	390919-S	Differential housing cover bolts
3	4033	Differential housing cover
4	389546-S	Differential drive pinion nut
5	4851	Rear axle pinion flange
6	4859	Rear pinion oil seal deflector
7	4676	Rear pinion oil seal
8	4670	Rear pinion oil seal slinger
9	4621	Outer pinion bearing
10	4662	Drive pinion collapsible spacer
11	4010	Differential housing
12	4B416	Halfshaft housing seals
13	13277	Selective snap ring
14	4067	Differential bearing shim
15	4222	Differential bearing cups
16	46108-S	Bearing cap bolt
17	—	Bearing cap
18	4204	Differential case
19	4982	Differential ring gear bolts
20	4209	Differential ring gear
21	4209	Differential pinion gear
22	4630	Inner pinion bearing
23	4663	Differential pinion bearing adjustment shim
24	4628	Inner pinion bearing cup
25	4616	Outer pinion bearing cup
26	4221	Differential bearings
27	4241	Differential pinion shaft roll pin
28	4211	Differential pinion shaft

29	4215	Differential pinion gears
30	4230	Differential pinion gear thrust washers
31	4236	Differential side gears
32	4228	Differential side gear thrust washers
33	4B431	Rear axle housing support insulator

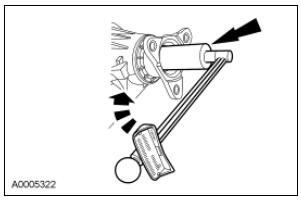
4. ⚠ **CAUTION: The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new Silicone Gasket and Sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.**

   Remove the differential housing cover.

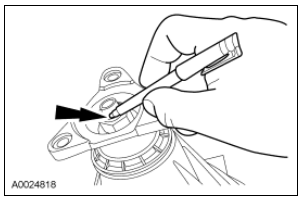
5. Mount the differential assembly in the special tool.



6. Install a Nm (lb-in) torque wrench on the differential drive pinion nut and record the torque necessary to maintain rotation of the differential pinion gear through several revolutions.

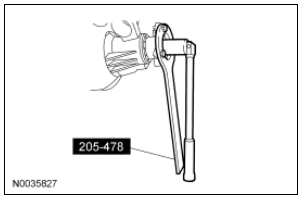


7. Index-mark the rear axle pinion flange to the differential pinion stem.

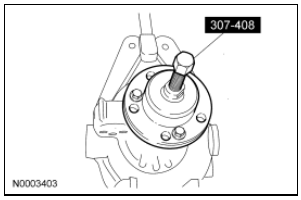


8. ⚠ **CAUTION: After removing the differential drive pinion nut, discard it. Use a new differential drive pinion nut for installation.**

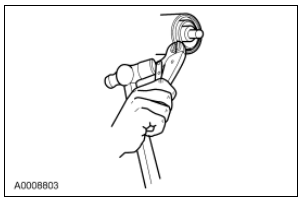
   Use the special tool to hold the rear axle pinion flange while removing the differential drive pinion nut.



9. Using the special tool, remove the rear axle pinion flange.

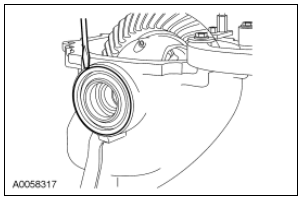


10. Use a screwdriver to force up the metal flange of the rear pinion oil seal. Install gripping pliers and strike with a hammer to remove the rear pinion oil seal.

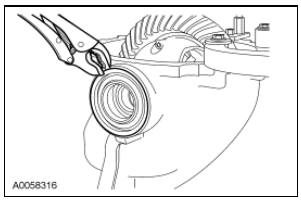


11. Remove the rear pinion oil seal slinger, outer pinion bearing and the drive pinion collapsible spacer.

12. Force up the metal flange on the halfshaft housing seal.



13. Install gripping pliers and strike with a hammer to remove the halfshaft housing seal from the housing.



14. Repeat for the other side.

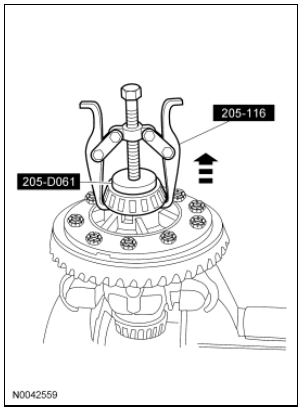
15. Remove the differential bearing cap.

16. Remove the differential case assembly.

17. Remove the selective snap ring, differential bearing shim and the differential bearing cups.

18. Remove the differential ring gear bolts, then the differential ring gear.

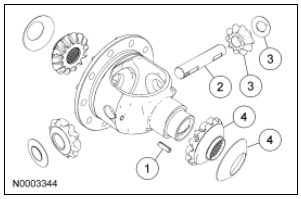
19. Using the special tools, remove the differential bearing.
    - Repeat for the other side.



20. **NOTE:** Drive the differential pinion shaft roll pin from the differential pinion shaft after the differential pinion shaft is removed from the differential case. Discard the differential pinion shaft roll pin.

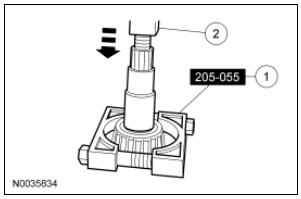
    If necessary, disassemble the differential case as follows:

    1. Using a drift punch and a hammer, drive the differential pinion shaft roll pin into the differential pinion shaft until bottomed out. The differential pinion shaft roll pin will remain in the differential pinion shaft when the differential pinion shaft is removed from the differential case.
    2. Remove the differential pinion shaft.
    3. Remove the differential pinion gears and differential pinion gear thrust washers.
    4. Remove the differential side gears and differential side gear thrust washers.



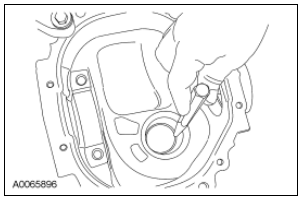
21. Remove the differential pinion gear.

22. Using the special tool and a suitable press, remove the inner pinion bearing.
    1. Position the special tool under the inner pinion bearing.
    2. Press the inner pinion bearing off of the differential pinion gear.



23. Using a drift punch and a hammer, remove the inner pinion bearing cup.

24. Using a drift punch and a hammer, remove the outer pinion bearing cup.

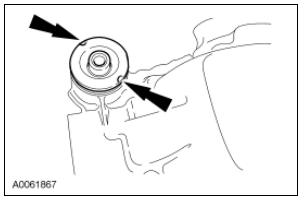


25. If necessary, remove the rear axle housing support insulator. For additional information, refer to Rear Axle Housing Support Insulator in this section.

26. Inspect all components for wear or damage. Install new components as necessary.

Assembly

1. If removed, install the rear axle housing support insulator. For additional information, refer to Rear Axle Housing Support Insulator in this section.

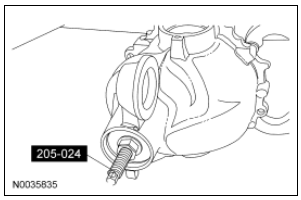


2. ⚠ **CAUTION: Always install a new differential pinion shaft roll pin.**

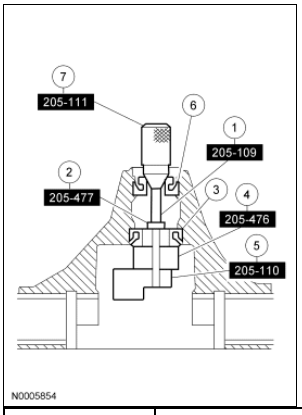
   If disassembled, assemble the differential case as follows:

   1. Install the differential side gears and differential side gear thrust washers.
   2. Install the differential pinion gears and differential pinion gear thrust washers.
   3. Install the differential pinion shaft.
   4. Install the differential pinion shaft roll pin so the top of the roll pin is flush with the differential case.

3. Using the special tool, install the differential drive pinion bearing cup(s).
   - Position the bearing cup(s) on the special tool.
   - Position the special tool and the bearing cup(s) in the differential housing.
   - Tighten the special tool to fully seat the bearing cup(s) in the bore(s).



4. Install the differential pinion bearings and special tools as shown.



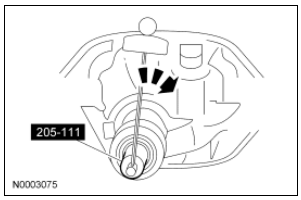
Item	Part Number	Description
1	205-109	Adapter for 205-S127
2	205-477	Depth Gauge/Aligner

3	4630	Rear (inner) pinion bearing
4	205-476	Depth Gauge, Drive Pinion
5	205-110	Adapter for 205-S127
6	4621	Front (outer) pinion bearing
7	205-111	Adapter for 205-S127

5. **NOTE:** This step duplicates differential pinion bearing preload.

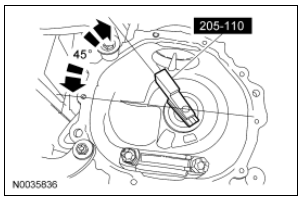
   Thread the special tool onto the screw.

   - Tighten to 2.2 Nm (20 lb-in) rotational torque.

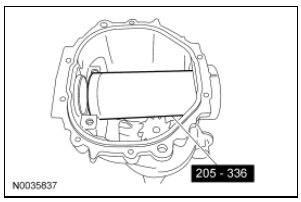


6. ⚠ **CAUTION: Offset the special tool to obtain an accurate reading.**

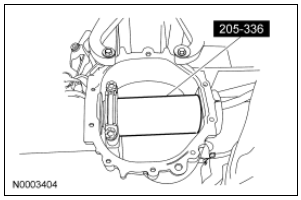
   Rotate the special tool several half turns to seat the differential pinion bearings. Position the special tool as shown.



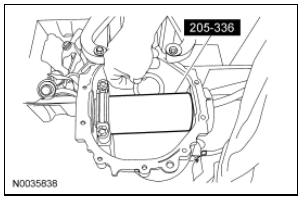
7. Install the special tool.
   - Position the special tool in the differential housing differential bearing seat.



8. Install the differential bearing cap, then install the differential bearing cap bolts.
   - Tighten to 105 Nm (77 lb-ft).



9. Use a differential pinion bearing adjustment shim as a gauge for shim selection. Check the differential pinion bearing adjustment shim thickness between the Gauge Block and the Gauge Tube. A slight drag indicates correct differential pinion bearing adjustment shim selection.

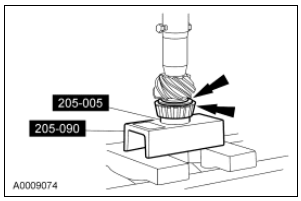


10. Remove all of the special tools.

11. **⚠ CAUTION: Use the same differential pinion bearings and differential pinion bearing adjustment shim from the differential pinion bearing adjustment shim selection procedure for final assembly.**

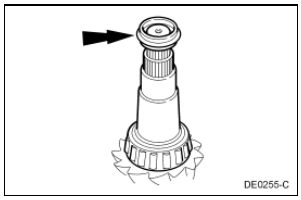
    Position the differential pinion bearing adjustment shim and the inner pinion bearing on the differential pinion stem.

12. Using the special tools and a suitable press, firmly seat the differential pinion bearing adjustment shim and inner pinion bearing on the differential pinion stem.



13. **⚠ CAUTION: Make sure the splines on the differential pinion stem are free of burrs. If burrs are evident, remove them using a fine crocus cloth.**

    Place a new drive pinion collapsible spacer on the differential pinion stem against the differential pinion stem shoulder.



14. Install the differential pinion gear with the drive pinion collapsible spacer in the differential housing.

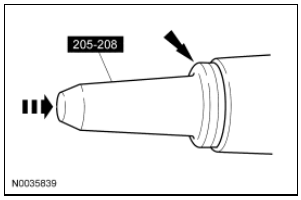
15. Install the outer pinion bearing and rear pinion oil seal slinger.

16. **⚠ CAUTION: Installation without the correct tool can result in early rear pinion oil seal failure.**

    ⚠ CAUTION: If the rear pinion oil seal becomes misaligned during installation, remove it and install a new one.

    NOTE: Coat the rear pinion oil seal lips with grease.

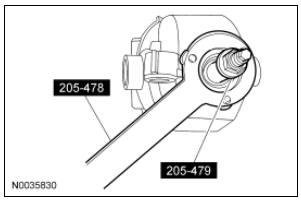
    Using the special tool, install the new rear pinion oil seal.



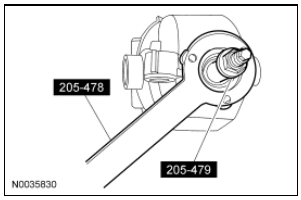
17. **NOTE:** Disregard the index marks if installing a new rear axle pinion flange.

    Position the rear axle pinion flange.

    - Lubricate the rear axle pinion flange splines with grease.
    - Position the rear axle pinion flange.



18. Using the special tools, install the rear axle pinion flange.

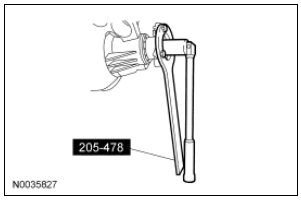


19. **⚠ CAUTION: Do not, under any circumstance, loosen the differential drive pinion nut to reduce differential pinion bearing preload. If it is necessary to reduce differential pinion bearing preload, install a new drive pinion collapsible spacer and differential drive pinion nut.**

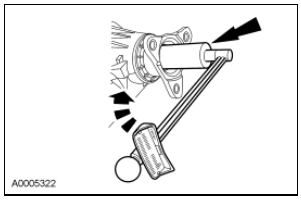
    ⚠ CAUTION: Remove the special tool while taking differential pinion bearing preload readings with the Nm (lb-in) torque wrench.

    Use the special tool to hold the rear axle pinion flange while tightening the differential drive pinion nut.

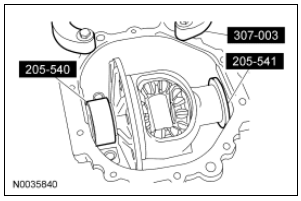
    - Rotate the differential pinion gear occasionally to make sure the differential pinion bearings seat correctly. Take frequent differential pinion bearing preload readings by rotating the differential pinion gear with a Nm (lb-in) torque wrench.



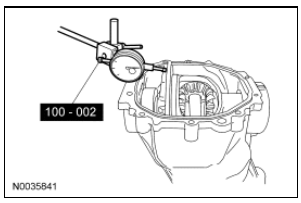
20. Tighten the differential drive pinion nut to set the differential pinion bearing preload.



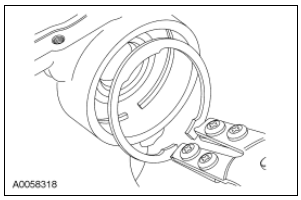
21. Install the special tools on the differential case.



22. Position the special tool on the differential case in the differential housing.



23. Install a unique set-up selective snap ring with a thickness of 2.54 mm (0.100 in).
    - The selective snap ring is available from the Ford dealer parts department.



24. **NOTE:** Repeat this step until obtaining a consistent reading.

    Measure the total end play.

    - Attach the special tools and position the indicator tip on the machined surface of the differential case flange.
    - Move the differential case to the left and the right (as far as possible).
    - Record the reading in Line A.

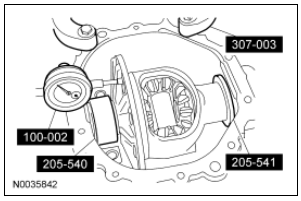
Differential Bearing Shim Selection Chart

8.0 Inch Lightweight Axle	Example	Actual
Line A Total end play without ring gear	0.230	
Line B Total end play with ring gear	0.193	
Line C Subtract Line B from Line A	0.037	
Line D Initial backlash clearance	0.016	0.016
Line E Set-up snap ring thickness	0.100	0.100
Line F Left master bearing compensation	0.100	0.100
Line G Carrier bearing preload	0.012	0.012

To determine the snap ring thickness, add lines C, D and E (Example: 0.037 + 0.016 + 0.100 = 0.153 snap ring thickness).

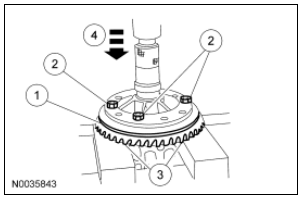
To determine the bearing shim thickness, add lines A, F and G. Subtract line C and D from the sum. Example:

- 0.230 + 0.100 + 0.012 = 0.342
- 0.342 - 0.037 - 0.016 = 0.289 bearing shim thickness

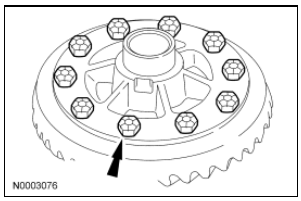


25. Remove the Dial Indicator and the differential case from the differential housing.

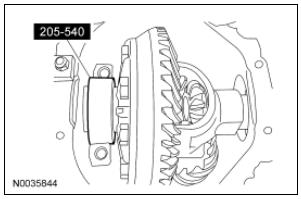
26. Install the differential ring gear.
    1. Place the differential ring gear on the differential case.
    2. Hand start 3 differential ring gear bolts to align the holes in the differential ring gear and the differential case.
    3. Place the differential case and differential ring gear onto the press bed blocks with the differential ring gear teeth facing downward.
    4. Press the differential ring gear into place.



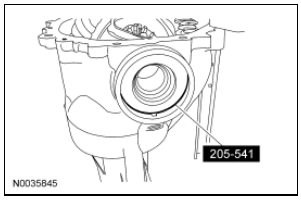
27. Install the remaining differential ring gear bolts.
    - Tighten to 120 Nm (89 lb-ft).



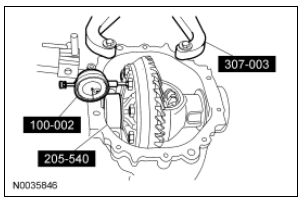
28. Place the differential case with the special tool into the differential housing.



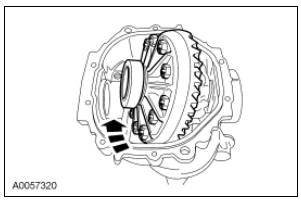
29. Install the special tool.



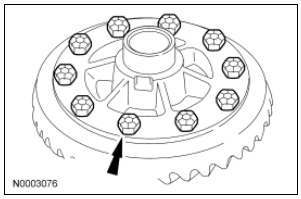
30. Measure the end play.
    - Attach the special tool and position the indicator tip on the machined surface of the differential case flange.
    - Rock the differential ring gear to allow full mesh with the drive pinion gear.
    - With the gears in full mesh, set the special tool to zero.
    - Move the differential case as far as possible to the left and note the reading.
    - Record the reading on the differential bearing shim selection procedure Line B.
        - ♦ Remove the special tool.



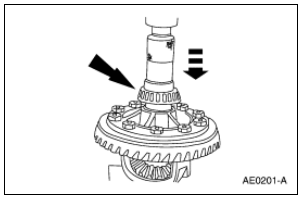
31. Remove the differential case from the differential housing.



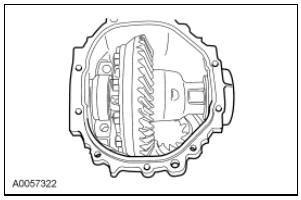
32. Remove the differential ring gear bolts. Apply Stud and Bearing Mount to the differential ring gear bolt threads, and reinstall the differential ring gear bolts.
    - Tighten to 120 Nm (89 lb-ft).



33. Using a suitable press, press the differential bearings on the differential case.



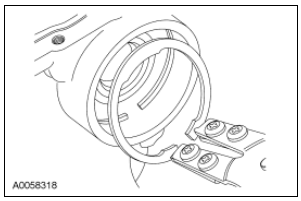
34. Place the differential case and differential bearing cups in the differential case.



35. **NOTE:** Select the correct size selective snap ring using the differential bearing shim selection chart.

    NOTE: To determine the thickness of the selective snap ring to be used, subtract Line B from Line A. Add Lines D and E to the difference. This is the thickness of the selective snap ring required.

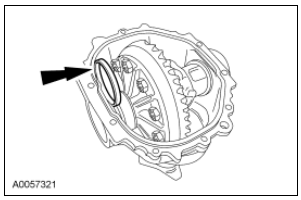
    Place the selective snap ring in the differential housing.



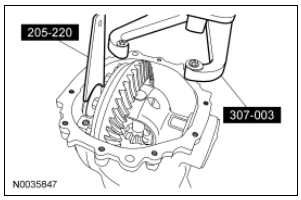
36. **NOTE:** Select the correct size selective bearing shim using the differential bearing shim selection chart.

    NOTE: To determine the thickness of the differential bearing shim to be used, add Lines A, F and G. Subtract Lines C and D from the sum. This is the thickness of the differential bearing shim required.

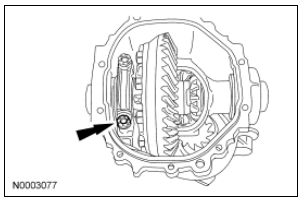
    Position the differential bearing shim indicated by the differential bearing shim selection chart.



37. Using the special tools, seat the differential bearing shim in the differential housing.

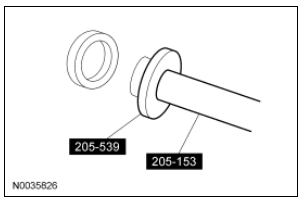


38. Install the differential bearing cap, then the differential bearing cap bolts in the original location.
    - Tighten to 105 Nm (77 lb-ft).

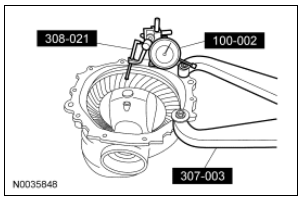


39. Lubricate the lips of the halfshaft housing seal with grease.

40. Using the special tools, install the halfshaft housing seal.



41. Using the special tools, measure the differential ring gear backlash at 4 equally spaced points.
    - Attach the special tool.
    - Position the special special tool tip centrally on a drive tooth.
    - Zero the indicator.
    - Turn the differential ring gear without turning the differential pinion gear. Record the indicator reading. The allowable backlash is 0.127 mm (0.005 in) to 0.228 mm (0.009 in) and must not vary more than 0.076 mm (0.003 in) between points measured. A backlash variation of more than 0.076 mm (0.003 in) between points checked indicates gear/case runout.
        - ♦ If backlash is within specifications, install the axle assembly.
        - ♦ To correct for a high or low backlash, proceed as follows.



42. To correct for high or low backlash, increase or decrease the thickness of the differential bearing shim and decrease or increase the thickness of the selective snap ring by the same amount. Refer to the following tables when adjusting the backlash. When the backlash is within specifications, install the differential assembly.

Backlash Change Required		Thickness Change Required	
mm	**in**	**mm**	**in**
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Snap Ring Size Chart—13277—

Numbers of Stripes and Color Code	Dimension A	
	mm	in
1 YEL	3.15	0.1240
2 YEL	3.17	0.1248
3 YEL	3.19	0.1256
4 YEL	3.21	0.1264
5 YEL	3.23	0.1272
1 WH	3.25	0.1280
2 WH	3.27	0.1287
3 WH	3.29	0.1295
4 WH	3.31	0.1303
5 WH	3.33	0.1311
1 GRN	3.35	0.1319
2 GRN	3.37	0.1327
3 GRN	3.39	0.1335
4 GRN	3.41	0.1343
5 GRN	3.43	0.1350
1 PINK	3.45	0.1358
2 PINK	3.47	0.1366
3 PINK	3.49	0.1374
4 PINK	3.51	0.1382
5 PINK	3.53	0.1390
1 BLU	3.55	0.1398
2 BLU	3.57	0.1406
3 BLU	3.59	0.1413
4 BLU	3.61	0.1421
5 BLU	3.63	0.1429
1 BLK	3.65	0.1437
2 BLK	3.67	0.1445
3 BLK	3.69	0.1453
4 BLK	3.71	0.1461
5 BLK	3.73	0.1469
1 BROWN	3.75	0.1476
2 BROWN	3.77	0.1484
3 BROWN	3.79	0.1492
4 BROWN	3.81	0.1500
5 BROWN	3.83	0.1508
1 YEL/1 BLK	3.85	0.1516

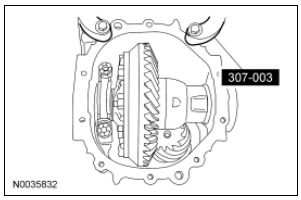
2 YEL/1 BLK	3.87	0.1524
3 YEL/1 BLK	3.89	0.1531
4 YEL/1 BLK	3.91	0.1539
5 YEL/1 BLK	3.93	0.1547
1 WH/1 BLK	3.95	0.1555
2 WH/1 BLK	3.97	0.1563
3 WH/1 BLK	3.99	0.1571
4 WH/1 BLK	4.01	0.1579
5 WH/1 BLK	4.03	0.1587
1 GRN/1 BLK	4.05	0.1594
2 GRN/1 BLK	4.07	0.1602
3 GRN/1 BLK	4.09	0.1610
4 GRN/1 BLK	4.11	0.1618
5 GRN/1 BLK	4.13	0.1626
1 PINK/1 BLK	4.15	0.1634
2 PINK/1 BLK	4.17	0.1642
3 PINK/1 BLK	4.19	0.1650
4 PINK/1 BLK	4.21	0.1657
5 PINK/1 BLK	4.23	0.1665

Differential Shim Size Chart — 4067 —

Numbers of Stripes and Color Code	Dimension A	
	mm	in
2—C-COAL	7.7978- 7.8105	0.3070- 0.3075
1—C-COAL	7.7470- 7.7597	0.3050- 0.3055
5—BLU	7.6962- 7.7089	0.3030- 0.3035
4—BLU	7.6454- 7.6581	0.3010- 0.3015
3—BLU	7.5946- 7.6073	0.2990- 0.2995
2—BLU	7.5458- 7.5565	0.2970- 0.2975
1—BLU	7.493- 7.505	0.2950- 0.2955
5—PINK	7.4422- 7.4549	0.2930- 0.2935
4—PINK	7.3914- 7.4041	0.2910- 0.2915
3—PINK	7.3406- 7.3533	0.2890- 0.2895
2—PINK	7.2898- 7.3025	0.2870- 0.2875
1—PINK	7.2390- 7.2517	0.2850- 0.2855
5—GRN	7.1882- 7.2009	0.2830- 0.2835
4—GRN	7.1374- 7.1501	0.2810- 0.2815
3—GRN	7.0866- 7.0993	0.2790- 0.2795
2—GRN	7.0358- 7.0485	0.2770- 0.2775
1—GRN	6.9850- 7.0485	0.2750- 0.2755
5—WH	6.9342- 6.9469	0.2730- 0.2735

4—WH	6.8834- 6.8961	0.2710- 0.2715
3—WH	6.8326- 6.8453	0.2690- 0.2695
2—WH	6.7818- 6.7945	0.2670- 0.2675
1—WH	6.7310- 6.7437	0.2650- 0.2655
5—YEL	6.6802- 6.6929	0.2630- 0.2635
4—YEL	6.6294- 6.6421	0.2610- 0.2615
3—YEL	6.5786- 6.5913	0.2590- 0.2595
2—YEL	6.5278- 6.5405	0.2570- 0.2575
1—YEL	6.4770- 6.4897	0.2550- 0.2555
5—ORNG	6.4262- 6.4389	0.2530- 0.2535
4—ORNG	6.3754- 6.3881	0.2510- 0.2515
3—ORNG	6.3246- 6.3373	0.2490- 0.2495
2—ORNG	6.2738- 6.2865	0.2470- 0.2475
1—ORNG	6.2223- 6.2357	0.2450- 0.2455
2—RED	6.1722- 6.1849	0.2430- 0.2435
1—RED	6.1214- 6.1341	0.2410- 0.2415

43. Remove the differential assembly from the special tool.



44. ⚠ **CAUTION: The differential housing cover must be installed within 15 minutes of application of the Silicone Gasket and Sealant.**

    ⚠ **CAUTION: Allow the Silicone Gasket and Sealant to cure for one hour before filling the axle with lubricant.**

    Apply a continuous bead of Silicone Gasket and Sealant to the differential housing cover mounting surface, then install the differential housing cover.

45. Install the rear axle assembly. For additional information, refer to Axle Assembly in this section.

46. Fill the axle.
    - Use Rear Axle Lubricant to 3-5 mm (1/8-3/16 in) from the bottom of the filler hole.
    - Tighten to 34 Nm (25 lb-ft).

Torque Specifications

Description	Nm	lb-ft
Rear axle wheel hub retainer	300	221
Suspension lower arm bolt	150	111
Toe-link bolt	55	41
Rear caliper bracket bolt	103	76
Anti-lock sensor bolt	7	5

Rear Drive Halfshafts

⚠ CAUTION: An inspection of the outer and inner boots is necessary so that if damage or grease leakage is evident, installation of a new halfshaft can take place immediately. Continued operation with damage or grease leakage will result in CV joint wear and noise due to contamination and loss of the CV joint grease.

- The RH and LH halfshafts are different lengths, with the RH halfshaft being the longer of the two.
- Inboard and outboard CV joints connect to a splined shaft. A circlip stopper holds the cross groove inboard race assembly (inboard CV joint) together.
- An axle circlip retains the splined inboard CV joint to the differential side gear. Install a new axle circlip every time you remove the halfshaft from the vehicle.
- A rear axle wheel hub retainer secures the side shaft assembly (interconnecting shaft and outboard CV joint) to the rear hub. Install a new rear axle wheel hub retainer every time you remove the halfshaft from the vehicle.

Halfshaft Handling

⚠ CAUTION: Never pick up or hold the halfshaft only by the inboard or outboard CV joint.

Handle all halfshaft components carefully during removal and installation procedures.

- The halfshaft assemblies are not repairable. Install a new assembly if worn/damaged.
- To separate the halfshaft from the rear hub, press the outboard CV joint from the rear hub.
- To separate the halfshaft from the differential, apply a load to the back face of the inboard CV joint assembly to overcome the axle circlip.
- Do not over-angle the CV joints.
- Damage will occur to an assembled inboard CV joint if it is over-plunged outward from the joint housing.
- Never use a hammer to remove or install the halfshafts.
- Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft.
- Do not allow the boots to contact sharp edges or hot exhaust components.
- Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the CV joints.
- Do not drop assembled halfshafts. The impact will cut the boots from the inside without evidence of external damage.

Wheel and Tire Balancing, Rear

⚠ WARNING: Do not balance the rear wheels and tires while mounted on the vehicle. Possible tire disintegration, differential or halfshaft failure can result, causing personal injury or extensive component damage. Use an off-vehicle wheel and tire balancer only.

Hoisting

⚠ CAUTION: Use a frame-contact hoist only. Vehicle or component damage can result if other types of hoists are used.

Never raise the vehicle using the halfshafts as lift points.

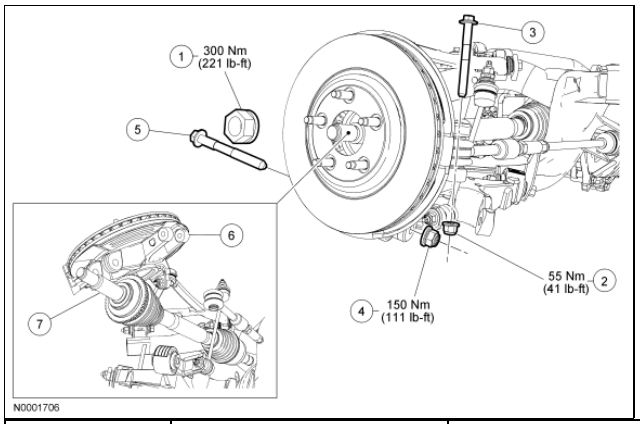
Rear Drive Halfshafts

Refer to Section 205-00 .

Halfshaft

Special Tool(s)

ST1712-A	Differential Plug 205-294 (T89P-4850-B)
	Protector, Differential Seal 205-506
ST2309-A	Halfshaft Removal Tool 205-475
ST1516-A	Hub Remover/Replacer 204-069 (T81P-1104-C)
ST1517-A	Metric Hub Remover Adapter 205-237 (T86P-1104-A1)
ST1518-A	Metric Hub Remover Adapters 204-085 (T83P-1104-BH)



Item	Part Number	Description
1	4B423	Rear axle wheel hub retainer
2	W520213-S	Toe link nut
3	W705517-S	Toe link bolt
4	W705518-S	Suspension lower arm nut
5	W705516-S	Suspension lower arm bolt
6	3K185	Rear wheel knuckle assembly
7	3514	Rear halfshaft assembly

Removal

1. ⚠ **CAUTION: Do not begin this procedure unless:**

- a new rear axle wheel hub retainer is available.
- a new axle circlip is available.
- you have read Halfshaft Handling in this section.

With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

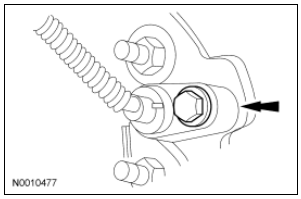
2. Remove the rear wheel and tire assembly. For additional information, refer to Section 204-04 .

3. Remove and discard the rear axle wheel hub retainer.

4. **⚠ CAUTION: When removing the caliper, never allow it to hang from the brake hose. Provide a suitable support.**

   Remove the rear brake caliper and support bracket as an assembly.

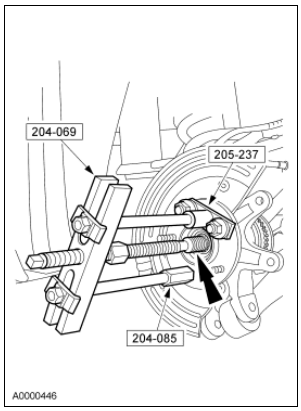
5. Remove the rear anti-lock speed sensor from the hub.



6. Remove and discard the suspension lower arm nut and bolt.

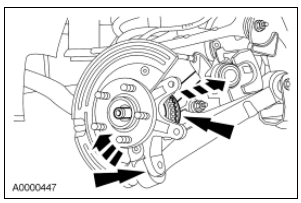
7. Remove the toe-link nut and bolt.

8. Using the special tools, press the outboard CV joint until it is loose in the hub.

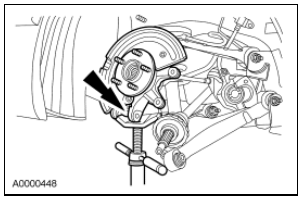


9. **⚠ CAUTION: Do not over-angulate the outboard CV joint or damage the boot.**

   While raising the knuckle, remove the CV joint from the hub.

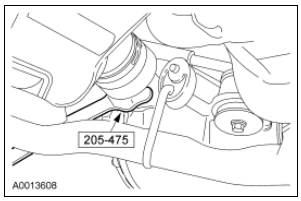


10. Position the knuckle to gain clear access for the halfshaft removal.



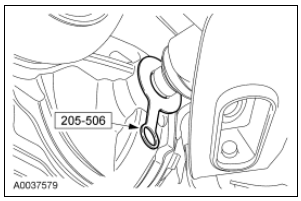
11. ⚠ **CAUTION: The crown of the tool forks must face away from the axle housing. Position the special tool correctly between the CV joint and the axle housing so as not to damage the differential seal.**

    Using the special tool, exert enough pressure to overcome the axle circlip and separate the CV joint from the differential side gear.

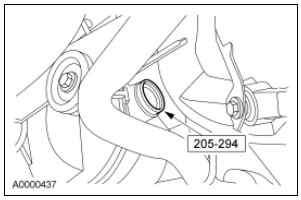


12. ⚠ **CAUTION: To prevent damage to the axle shaft oil seal, install the special tool before removing the inboard CV joint housing from the axle.**

    Install the special tool.



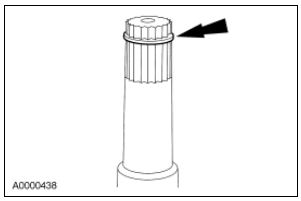
13. Install the special tool.



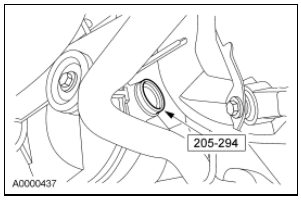
Installation

1. **NOTE:** This procedure applies to both the LH and RH halfshafts.

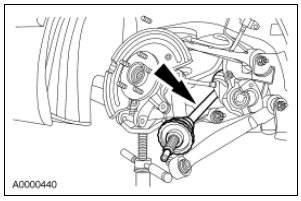
   Install a new axle circlip.



2. Remove the special tool.

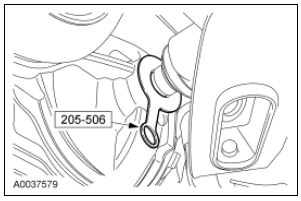


3. Position the halfshaft for installation.

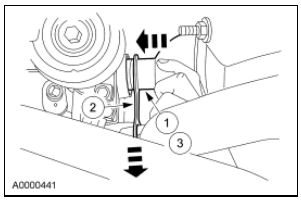


4. ⚠ **CAUTION: Differential seal damage will occur if installing the halfshaft without the special tool installed.**

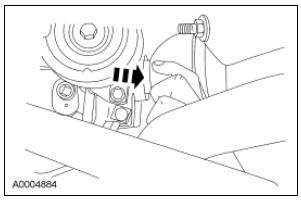
   Install the special tool.



5. Seat the CV joint in the differential side gear.
   1. Slide the CV joint into the axle housing until the shaft splines are past the differential seal.
   2. Remove the special tool.
   3. Align the CV joint and side gear splines, and slide the joint into the gear until it seats.
      - ♦ When seated, the axle circlip will lock the CV joint in the differential side gear.

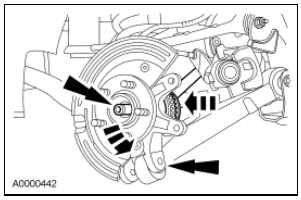


6. Check the axle circlip engagement by attempting to pull the inboard CV joint out of the differential side gear.
   - If the circlip is not seated, push the CV joint inward until the circlip is fully engaged in the differential side gear.



7. ⚠ **CAUTION: Do not over-angulate the outboard CV joint or damage the boot.**

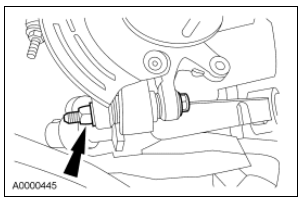
   While raising the knuckle, install the CV joint into the hub, then position the knuckle onto the lower control arm.



8. ⚠ **CAUTION: Position the suspension at curb ride height before tightening the bolt and nut.**

   Install the new suspension lower arm bolt and nut.

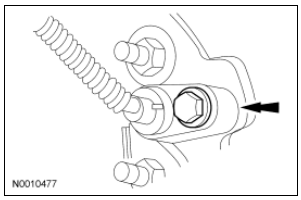
   - Tighten to 150 Nm (111 lb-ft).



9. Install the toe-link nut and bolt.
   - Tighten to 55 Nm (41 lb-ft).

10. Install the rear brake caliper and bracket and the bolts.
    - Tighten to 103 Nm (76 lb-ft).

11. Install the rear brake anti-lock sensor and the bolt.
    - Tighten to 7 Nm (5 lb-ft).



12. Install the new rear axle wheel hub retainer.
    - Tighten to 300 Nm (221 lb-ft).

13. Install the rear wheel and tire assembly. For additional information, refer to Section 204-04 .

General Specifications

Item	Specification
Brake Disc	
Front brake disc minimum thickness	28.0 mm (1.102 inch)
Rear brake disc minimum thickness	18.5Â mm (0.728Â inch)
Brake Pads	
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 inch)
Brake pad minimum thickness	3.0 mm (0.118 inch)
Lubricant	
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-1)	—
Silicone Brake Caliper Grease and Dielectric Compound XG-3	ESE-M1C171-A

Torque Specifications

Description	Nm	lb-ft
Front brake caliper bleeder screw	13	10
Rear brake caliper bleeder screw	20	15

Brake System

The brake system consists of:

- a vacuum-assisted power braking system.
- a power adjustable brake pedal with memory function (if equipped).
- a diagonal split hydraulic system.
- front disc brakes utilizing a dual piston brake caliper and disc system.
- rear disc brakes utilizing a single piston brake caliper and disc system.
- an electronic parking brake (EPB) system that actuates an integral system within the rear brake discs.
- a 4-wheel anti-lock brake system (ABS) available in 2 variants: ABS with Traction Control or ABS with Traction Control and Stability Assist (also referred to as Interactive Vehicle Dynamics [IVD] or Advance Trac). Refer to Section 206-09 .

Adjustable Pedals

The vehicle may be equipped with an adjustable brake and accelerator pedal system. Using the adjustable pedal switch, located on the instrument panel, the driver can adjust the brake and accelerator pedals for a more comfortable driving position.

Memory Adjustable Pedal Operation

The power adjustable pedals memory feature stores the current accelerator and brake pedal positions and recalls the previously stored pedal positions for a specified driver as directed by the memory feature. The adjustable pedals with memory feature:

- are operational with the ignition switch in the ON or OFF position.
- can be adjusted forward or rearward using the adjustable pedal switch.
- retains 2 separate driver's pedal positions.
- updates the retained pedal position when that driver's memory is stored.
- moves the pedal to the retained pedal position when that driver's memory is recalled.
- stops pedal movement when any manual actuation of the pedal adjustment switch occurs while memory recall is moving the pedal.

Programming Adjustable Pedal Positions

Programming adjustable pedal positions can be accomplished by doing the following:

- An adjustable pedal position can be stored at any time. To store the adjustable pedal position to memory, the driver must move the pedals to the preferred position using the adjustable pedal switch. The driver must then press the memory SET switch, activating the memory SET switch light emitting diode (LED). Within 5 seconds (before the LED goes out) the driver must select memory position No. 1 or No. 2.
- If no memory switch input is received within the 5-second time limit, the operation is aborted and the memory SET switch LED is turned OFF. If one of the following inputs is received during the 5-second programming limit, the operation is aborted and the memory SET switch LED is turned OFF:
    - ♦ Adjustable pedal switch

- ♦ Power driver seat switch
- ♦ Power outside rearview mirrors switch
- ♦ Memory SET switch

Recalling a Stored Adjustable Pedal Position

Once the driver has stored a preferred adjustable pedal position, the driver can recall the setting by pressing the corresponding memory switch, or by using a programmed remote keyless entry transmitter. Recalling a stored adjustable pedal position can be accomplished by doing the following:

- The driver can recall a preferred adjustable pedal position by pressing one of the memory recall switches. Pressing memory switch 1 initiates a recall of the adjustable pedal position stored in memory No. 1. Pressing memory switch 2 initiates a recall of the adjustable pedal position stored in memory No. 2.
- A remote keyless entry transmitter can be used to recall previously set memory positions. The remote keyless entry transmitters are manufactured with an assigned personality number (No. 1 or No. 2). The remote keyless entry transmitter assigned with personality No. 1 is capable of recalling only memory position No. 1. Similarly, the remote keyless entry transmitters assigned with personalities No. 1 and No. 2 can recall memory positions No. 1 and No. 2 respectively.
- Memory recall occurs when the UNLOCK switch is pressed on the remote keyless entry transmitters. A second press of the UNLOCK switch, which unlocks the passenger doors, does not initiate a memory recall.
- A memory recall in progress does not prohibit the initiation of another memory recall; the most recently requested memory recall is executed. For additional memory system information, refer to Section 501-10 .

Electronic Parking Brake (EPB)

The electronic parking brake (EPB) replaces the function of the conventional hand brake lever system. The EPB has 2 functions. Its primary function is to hold the vehicle up to a 30% grade. The secondary function is to be able to decelerate the vehicle by using the EPB as an emergency brake.

The EPB system:

- has a switch located in the front console behind the gear selector. The switch is hardwired to the EPB module. It includes a yellow fault warning lamp.
- has a control module that communicates with the other vehicle modules through the SCP network.
- uses an electric motor and gearbox assembly to apply and release tension on a conventional parking brake cable system.

Electronic Parking Brake (EPB) Operation

Pull the parking brake switch upward to engage the parking brake. Release the switch, and it returns to the neutral position. To release the parking brake, make sure the ignition is turned to ON, press the brake pedal, then push the parking brake switch down. The instrument cluster BRAKE warning lamp illuminates and remains illuminated until the parking brake is released.

The electronic parking brake (EPB) will automatically release when the gearshift lever is moved from P (Park) with the ignition ON. The EPB also disengages if a gear is selected and the accelerator pedal is pressed. The EPB will not release when the release switch is activated. If the battery is disconnected, the EPB system must be reset; the vehicle message center will display "APPLY PARK BRAKE" or "APPLY ((P))".

Electronic Parking Brake (EPB) Resetting

NOTE: The electronic parking brake (EPB) can be released after the battery is reconnected.

The electronic parking brake (EPB) system must be reset whenever the battery has been disconnected or has been in a state of discharge.

To reset the EPB system, follow the steps:

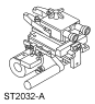
1. Place gearshift selector in the park (P) position.
2. Turn the ignition switch ON.
3. Press the brake pedal and at the same time pull on the EPB switch.
4. Then release the EPB switch. To release the EPB switch, push on the EPB switch while depressing the brake pedal.

Brake System

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Refer to Wiring Diagrams Cell 127 for schematic and connector information.

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2205-A	ABS and Brake Pressure Test Kit 107-02351 or equivalent
 ST2032-A	On-Car Brake Lathe 201-00002 or equivalent

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—

Inspection and Verification

⚠ WARNING: Use of any brake fluid other than the approved DOT 3 will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ **CAUTION: Do not spill brake fluid onto painted surfaces. If spilled, wipe up immediately.**

NOTE: Always check the fluid level in the brake master cylinder reservoir before carrying out the test procedures. If the fluid level is not at the correct level, clean the reservoir cap before removing, then add DOT 3 brake fluid.

NOTE: Prior to carrying out any diagnosis, make sure the red brake warning indicator is functional. Refer to Section 413-01 .

The first indication that something may be wrong in the brake system is a change in the feeling through the brake pedal. The brake warning indicator in the instrument cluster and the brake fluid level in the brake master cylinder reservoir are also indicators of system concerns.

If a wheel is locked and the vehicle must be moved, open a bleeder screw at the locked wheel to let out enough fluid to relieve the pressure. Close the bleeder screw. This bleeding operation may release the brakes but does not correct the cause of the concern. If this does not relieve the locked wheel condition, repair the locked components before proceeding.

Inspect all the hoses and connections. All unused vacuum connectors should be capped. Make sure the hoses and their connections are correctly secured and in good condition with no holes, or soft or collapsed areas.

Road Test

The technician should have a thorough knowledge of the brake system operation and accepted general braking guidelines in order to detect any problems.

Select a road that is reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Avoid crowned roads.

A key factor in evaluating brake concerns is the deceleration rate. This varies from vehicle to vehicle and with changes in operating conditions. It is evident how well the brakes are working after just a few applications.

For low or spongy brake pedal concerns:

- check and, if necessary, refill the brake master cylinder reservoir.
- bleed the brake system and retest the brake pedal feel.
- if the brake pedal is still low or feels spongy, check the brake pedal mounting for looseness and correct installation. Check the brake booster and the brake master cylinder for loose mounting. Correct as necessary and retest the system for normal operation.

For a slow or incomplete brake pedal return concern:

- inspect for binding, damage, correct installation, or interference at the brake pedal.
- check the brake booster for binding, damage and correct installation.

Brake Pads

NOTE: It is not necessary to install new brake pads if the friction material properties are within specification. It is also not necessary to install new brake pads when the brake discs are machined.

- Remove the brake pads. For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .

- Inspect and measure the thickness of the brake pad friction material.
    - Install new brake pads if the thickness of the friction material is less than 3.0Â mm (0.118 inch). For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .
    - Compare all 4 front or rear pads for uneven wear. Install new brake pads if the thickness of the friction material varies from pad to pad by more than 2.0Â mm (0.079 inch). For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .
    - Install new brake pads if there are missing chunks or cracks in the lining through to the backing plate. For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .
    - If the friction material shows taper wear (i.e. the thickness varies by more than 3.0Â mm [0.118 inch] in any direction) verify the caliper guide pins are functioning correctly. For additional information, refer to Brake Caliper Guide Pins in this section.

Brake Discs

⚠ CAUTION: Using an impact tool without a torque socket leads to unevenly tightened lug nuts. This causes brake disc on-vehicle lateral runout and brake roughness.

NOTE: It is generally not necessary to install new brake discs to address brake noise concerns.

- Remove the brake disc. For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .
- Inspect the brake disc and measure the brake disc thickness in a minimum of 4 places around the circumference of the brake disc. Record the measurements.
    - Install new brake discs if any thickness measurement is less than the minimum specification. For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .
    - Install new brake discs if cracked. For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .
    - Machine the brake discs if the diagnosis has revealed vibration in the steering wheel, seat, or pedal while braking. Heavily scored brake discs, similar to that caused by pads worn down to the backing plate, should also be machined. In order to machine, the thickness of the discs must be greater than the minimum thickness specification. For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .

Brake Caliper

Inspect the brake calipers for the following:

- Brake fluid leaks
- Tears or cracks in the boots and seals
- Binding and corrosion of the caliper piston
- Correct operation of the guide pins. For front disc brakes, refer to Section 206-03 or for rear disc brakes Section 206-04 .

Brake Caliper Guide Pins

⚠ CAUTION: Do not use power tools for caliper guide pin bore cleaning.

The guide pins should slide with a reasonable amount of hand force. If the brake pads show taper wear or the guide pins are difficult to move, carry out the following steps:

NOTE: If a guide pin kit is not available, install a new brake caliper assembly.

- Disassemble the guide pins. For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .
- Use a wire brush, rolled-up sandpaper, or emery cloth to remove all corrosion and foreign material from the caliper guide pin bores. Clean any remaining foreign material from the bores with brake parts cleaner and compressed air.
- Install new brake pads if the lining is not within specification. For front disc brakes, refer to Section 206-03 or for rear disc brakes, refer to Section 206-04 .
- Assemble the caliper guide pins using new caliper seals, boots and guide pins. Use an ample amount of grease to lubricate the bores and guide pins.

Brake Lines and Tubes

⚠ CAUTION: Never use copper tubing. It is subject to fatigue, cracking and corrosion which could result in brake tube failure.

- Double-wall steel tubing is used throughout the brake hydraulic system. All brake tube fittings must be correctly double flared to provide strong, leakproof connections. When bending tubing to fit the underbody or rear axle contours, be careful not to kink or crack the tube.
- If a section of the brake tube is damaged, the entire section must be installed new with a tube of the same type, size, shape and length.
- When installing the hydraulic brake tubing, hoses or connectors, tighten all connections to specification. After installation, bleed the brake system. For additional information, refer to Brake System Bleeding in this section.
- The wet appearance on the outer cover of rubber brake hoses is called "sweating." This is a normal condition for neoprene rayon braided hose and is not a sign of leakage or cause to install a new hose.

Install a new flexible brake hose if the hose shows signs of softening, cracking or other damage.

When installing a new brake hose, position the hose to avoid contact with other vehicle components.

Non-Pressure Leaks

NOTE: The wet appearance on the outer cover of rubber brake hoses is called "sweating." This is a normal condition for neoprene rayon braided hose. The sweating condition is not evidence of a brake fluid leak and will not result in a loss of pressure in the system.

The only part of the brake system that could have a brake fluid loss that does not appear when the system is under pressure is the brake master cylinder reservoir under the following conditions:

- Missing or poorly-fitted brake master cylinder filler cap
- Punctured or otherwise damaged brake master cylinder reservoir
- Missing or damaged brake master cylinder filler cap gasket
- Missing, damaged or poorly-fitted sealing grommets between the brake master cylinder and the brake master cylinder reservoir

The brake master cylinder reservoir grommets are not repairable and must be installed new as part of a new brake master cylinder reservoir.

Brake Master Cylinder — Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of service:

Condition 1: During normal operation of the brake master cylinder, the fluid level in the brake master cylinder reservoir rises during brake application and falls during release. The net fluid level (such as after brake application and release) will remain unchanged.

Condition 2: A trace of brake fluid exists on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore and seal.

Condition 3: The fluid level decreases with pad wear.

Brake Master Cylinder — Abnormal Conditions

Changes in the brake pedal feel or travel are indicators that something could be wrong in the brake system. GO to Symptom Chart for abnormal condition diagnosis.

Brake Booster

Inspect the brake booster for the following:

- Excessive corrosion or damage
- Leakage in the vacuum connections
- Kinks or leakage in the vacuum hoses
- Correct operation of the brake booster check valve

Changes in the brake pedal feel or travel are indicators that something could be wrong in the brake system. GO to Symptom Chart for abnormal condition diagnosis.

Adjustable Pedals

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage. Refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
• Adjustable pedals • Adjustable pedal motor and cables	• Adjustable pedal switch • Central junction box (CJB) fuse 30 (10A) • Wiring harness • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the diagnostic tool does not power up, refer to the diagnostic tool manual.

5. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP, UBP, CAN or ISO circuit faults; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for front electronic module (FEM), refer to Section 419-10 .
   - System passed, retrieve and record the continuous DTCs and the carry out self-test diagnostics for the FEM.

6. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index.

7. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Defective	FEM	INSTALL a new FEM. REFER to Section 419-10 .
B1990	Pedal Forward/Rearward Potentiometer Feedback Circuit Failure	FEM	GO to Pinpoint Test D .
B2358	Adjustable Pedal Switch Failure	FEM	GO to Pinpoint Test B .

Symptom Chart

Symptom Chart

Pinpoint Tests

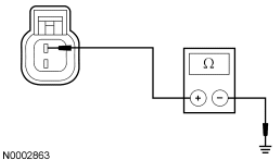
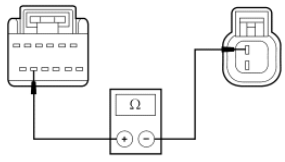
Pinpoint Test A: The Red Brake Warning Indicator Lamp Is Always On

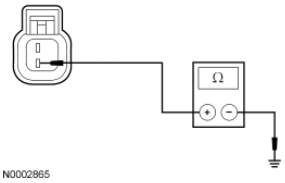
Normal Operation

The red brake warning indicator is located on the instrument cluster. When the brake fluid in the brake master cylinder reservoir is less than an acceptable level, and when the parking brake is engaged, the red brake warning indicator illuminates.

Possible Causes
- Low brake fluid level
- Parking brake engaged
- Circuit 31-CG7 (BK/BU) open
- Circuit 8-GC7 (WH/RD) open or short to ground
- Low brake fluid level switch
- Front electronics module (FEM)
- Instrument cluster

PINPOINT TEST A: THE RED BRAKE WARNING INDICATOR IS ALWAYS ON

Test Step	Result / Action to Take
A1 ISOLATE THE BRAKE FLUID LEVEL SWITCH	
• Ignition OFF. • Disconnect: Brake Fluid Level Switch C1395. • Ignition ON. • Monitor the brake warning indicator. • **Is the brake warning indicator lamp on?**	**Yes** GO to A2 . **No** INSTALL a new brake fluid level switch. TEST the system for normal operation.
A2 CHECK CIRCUIT 8-GC7 (WH/RD) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: front electronic module (FEM) C201c. • Measure the resistance between brake fluid level switch C1395-1, circuit 8-GC7 (WH/RD), harness side and ground.  N0002863 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A3 . **No** REPAIR the circuit. TEST the system for normal operation.
A3 CHECK CIRCUIT 8-GC7 (WH/RD) FOR AN OPEN	
• Measure the resistance between FEM C201c-11, circuit 8-GC7 (WH/RD), harness side and brake fluid level switch C1395-1, circuit 8-GC7 (WH/RD), harness side.  N0002986 • **Are the resistances less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK CIRCUIT 31-GC7 (BK/BU) FOR AN OPEN	
• Measure the resistance between brake fluid level switch C1395-2, circuit 31-GC7 (BK/BU), harness side and ground.	**Yes** REFER to Section 206-05 to diagnose the parking brake. **No** REPAIR the circuit. TEST the system for normal operation.

 N0002865 • **Is the resistance less than 5 ohms?**	

Pinpoint Test B: DTC B2358: Adjustable Pedal Switch Failure

Refer to Wiring Diagrams Cell 127 for schematic and connector information.

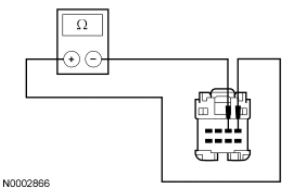
Normal Operation

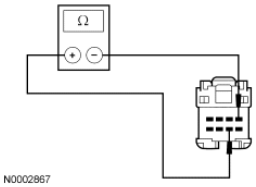
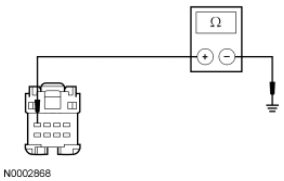
The adjustable brake and accelerator pedals with memory feature are controlled by the front electronic module (FEM) and are operational with the ignition switch ON or OFF. The FEM supplies voltage to the adjustable pedal 2-way motor until the switch is released or until the travel limit is reached. The memory feature allows the driver to program a personalized pedal position that can be recalled using the memory switches or the remote keyless entry (RKE) transmitters.

Possible Causes

- Adjustable pedal switch
- Circuit 31-AL19A (BK/GN) open

PINPOINT TEST B: DTC B2358: ADJUSTABLE PEDAL SWITCH FAILURE

Test Step	Result / Action to Take
B1 CHECK THE ADJUSTABLE PEDAL SWITCH REARWARD	
• Disconnect: Adjustable Pedal Switch C2089. • Press the adjustable pedal switch REARWARD and measure the resistance between adjustable pedal switch C2089-3, circuit 32-AL19 (WH/GN), component side, and C2089-4, circuit 31-AL19A (BK/GN), component side.  N0002866 • **Are the resistances less than 5 ohms?**	**Yes** GO to B2 . **No** INSTALL a new adjustable pedal switch. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B2 CHECK THE ADJUSTABLE PEDAL SWITCH FORWARD	
• Press the adjustable pedal switch FORWARD and measure the resistance between adjustable pedal switch C2089-7, circuit 34-AL19 (BU/BK), component side, and C2089-4, circuit 31-AL19A (BK/GN), component side.	**Yes** GO to B3 . **No** INSTALL a new adjustable pedal

 N0002867 • **Are the resistances less than 5 ohms?**	switch. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B3 CHECK CIRCUIT 31-AL19A (BK/GN) FOR AN OPEN	
• Measure the resistance between adjustable pedal switch C2089-4, circuit 31-AL19A (BK/GN), harness side, and ground.  N0002868 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new FEM. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The Adjustable Pedal Does Not Operate Correctly

Refer to Wiring Diagrams Cell 127 for schematic and connector information.

Normal Operation

The adjustable brake pedals operate forward or rearward when the adjustable pedal switch is pushed in either direction and current flows from the front electronic module (FEM) through circuit 34-AL19 (BU/BK) or circuit 32-AL19 (WH/GN). Ground to the switch is supplied by circuit 31-AL19A (BK/GN). The adjustable pedal motor receives voltage from the FEM through circuit 34-AL18 (BU/RD) (rearward) or circuit 35-AL18 (VT/BU (forward). The adjustable motor connects to a cable that transmits motor rotation to the adjustable brake pedal assembly. Another cable transmits motor rotation between the brake pedal assembly and the accelerator pedal assembly.

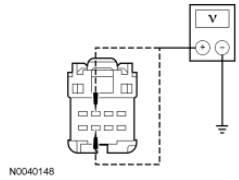
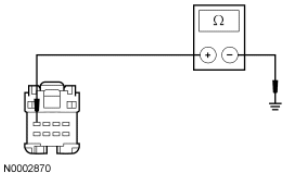
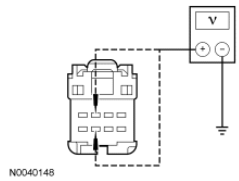
Possible Causes

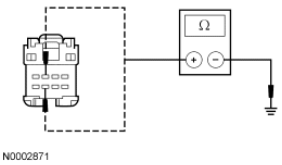
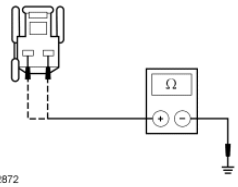
- Adjustable pedal motor
- Circuit 32-AL19 (WH/GN) open, short to ground or short to voltage
- Circuit 34-AL19 (BU/BK) open, short to ground or short to voltage
- Circuit 31-AL19A (BK/GN) open
- Circuit 34-AL18 (BU/RD) open
- Circuit 35-AL18 (VT/BU) open
- Adjustable pedal motor cables
- Adjustable pedal switch

PINPOINT TEST C: THE ADJUSTABLE PEDAL DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take

C1 CHECK THE MOTOR SOUND	
• Allow 2 minutes for the thermal overload to reset. • Operate the adjustable pedal control switch. • **Can the adjustable pedal motor be heard to operate?**	**Yes** GO to C2 . **No** GO to C6 .
C2 CHECK THE MOTOR INSTALLATION	
• Check the adjustable pedal motor for correct installation. • **Is the motor installation OK?**	**Yes** GO to C3 . **No** INSTALL the motor correctly. TEST the system for normal operation.
C3 CHECK THE ADJUSTABLE ACCELERATOR PEDAL SYSTEM	
• Disconnect the brake pedal-to-accelerator pedal cable. • Operate the adjustable pedal control switch. • **Does the adjustable brake pedal operate now?**	**Yes** REPAIR the adjustable accelerator pedal system. REFER to Section 310-02 . TEST the system for normal operation. **No** GO to C4 .
C4 INSPECT FOR FOREIGN MATERIAL	
• Inspect the adjustable brake pedal assembly for foreign material causing a binding condition. • **Is any foreign material found?**	**Yes** REMOVE the foreign material. TEST the system for normal operation. **No** GO to C5 .
C5 CHECK THE BRAKE PEDAL MOTOR CABLE	
• Remove the adjustable pedal motor. Refer to Section 206-06 . • Inspect the ends of the brake pedal motor cable for wear or damage. • **Are the cable ends OK?**	**Yes** GO to C6 . **No** INSTALL a new brake pedal motor cable. REFER to Section 206-06 . TEST the system for normal operation.
C6 CHECK FOR VOLTAGE TO THE ADJUSTABLE PEDAL SWITCH	
• Disconnect: Adjustable Pedal Switch C2089. • Measure the voltage between adjustable pedal switch C2089-3, circuit 32-AL19 (WH/GN), harness side and ground; and between adjustable pedal switch C2089-7, circuit 34-AL19 (BU/BK), harness side and ground.	**Yes** GO to C7 . **No** REPAIR circuit in question. TEST the system for normal operation.

 N0040148 • **Are the voltages greater than 10 volts?**	
C7 CHECK THE GROUND TO THE ADJUSTABLE PEDAL SWITCH	
• Measure the resistance between adjustable pedal switch C2089-4, circuit 31-AL19A (BK/GN), harness side and ground.  N0002870 • **Is the resistance less than 5 ohms?**	**Yes** GO to C8 . **No** REPAIR the circuit. TEST the system for normal operation.
C8 CHECK THE CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Disconnect: FEM C201b. • Measure the voltage between adjustable pedal switch C2089-3, circuit 32-AL19 (WH/GN), harness side and ground; and between adjustable pedal switch C2089-7, circuit 34-AL19 (BU/BK), harness side and ground.  N0040148 • **Is any voltage present?**	**Yes** REPAIR the circuit(s) in question. TEST the system for normal operation. **No** GO to C9 .
C9 CHECK THE CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between adjustable pedal switch C2089-3 , circuit 32-AL19 (WH/GN), harness side and ground; and between adjustable pedal switch C2089-7, circuit 34-AL19 (BU/BK), harness side and ground.	**Yes** GO to C10 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0002871 • **Are the resistances greater than 10,000 ohms?**	
C10 CHECK THE SWITCH-TO-MOTOR CIRCUITS CONTINUITY	
• Connect: Adjustable Pedal Switch C2089. • Disconnect: Adjustable Pedal Motor C2003. • Measure the resistance between adjustable pedal motor C2003-1, circuit 34-AL18 (BU/RD), harness side and ground; and between adjustable pedal motor C2003-2, circuit 35-AL18 (VT/BU), harness side and ground.  N0002872 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new adjustable pedal motor. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test D: DTC B1990: Pedal Forward/Rearward Potentiometer Feedback Circuit Failure

Normal Operation

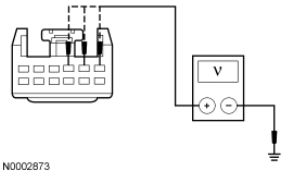
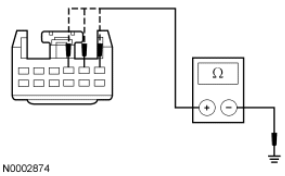
The adjustable brake and accelerator pedals with memory feature are controlled by the front electronic module (FEM) and are operational with the ignition switch ON or OFF. The FEM supplies voltage to the adjustable pedal 2-way motor until the switch is released or until the travel limit is reached. The memory feature allows the driver to program a personalized pedal position that can be recalled using the memory switches or remote keyless entry transmitters.

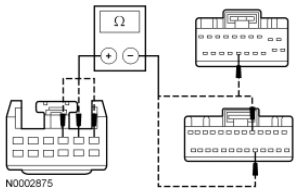
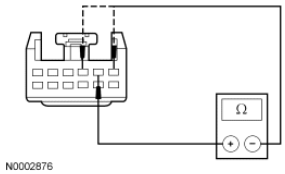
Possible Causes

- Circuit 8-AL18 (WH/RD) open, short to voltage or short to ground
- Circuit 7-AL18 (YE/RD) open, short to voltage or short to ground
- Circuit 9-AL18 (BN/RD) open, short to voltage or short to ground
- FEM
- Adjustable pedal potentiometer

PINPOINT TEST D: DTC B1990: PEDAL FORWARD/REARWARD FEEDBACK CIRCUIT FAILURE

Test Step	Result / Action to Take
D1 CHECK THE FRONT ELECTRONIC MODULE (FEM) FOR CORRECT OUTPUT PIDs	
• Use the adjustable pedal switch to move the pedals to a central position.	**Yes** REFER to Section

• Monitor the FEM pedal position PID while moving the adjustable pedal switch into the FORWARD position, then into the REARWARD position. • **Does the PID value decrease with forward movement and increase with rearward movement throughout the pedal's entire travel?**	419-10 for further diagnosis. CLEAR the DTC(s). REPEAT the self-test. **No** GO to D2 .
D2 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: FEM C201e. • Disconnect: FEM C201f. • Disconnect: Adjustable Pedal Potentiometer C268. • Measure the voltage between adjustable pedal potentiometer harness side and ground as follows: **Adjustable Pedal Potentiometer C268** / **Circuit** 1 / 9-AL18 (BN/RD) 2 / 8-AL18 (WH/RD) 3 / 7-AL18 (YE/RD)  N0002873 • **Is voltage present?**	**Yes** REPAIR the circuit(s). CLEAR the DTC(s). REPEAT the self-test. **No** GO to D3 .
D3 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between adjustable pedal motor C268-2, circuit 8-AL18 (WH/RD), harness side and ground; and between adjustable pedal motor C268-3, circuit 7-AL18 (YE/RD), harness side and ground; and between adjustable pedal motor C268-1, circuit 9-AL18 (BN/RD), harness side and ground.  N0002874 • **Are the resistances less than 10,000 ohms?**	**Yes** GO to D4 . **No** REPAIR the circuit in question. CLEAR the DTC(s). REPEAT the self-test.

D4 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR AN OPEN	
• Measure the resistance between adjustable pedal motor harness side and the FEM harness side as follows: **Adjustable Pedal Potentiometer C268** / **FEM (C201e, C201f)** C268-1, circuit 9-AL18 (BN/RD) / C201e-18, circuit 9-AL18 (BN/RD) C268-2, circuit 8-AL18 (WH/RD) / C201e-5, circuit 8-AL18 (WH/RD) C268-3, circuit 7-AL18 (YE/RD) / C201f-16, circuit 7-AL18 (YE/RD)  N0002875 • **Are the resistances less than 5 ohms?**	**Yes** GO to D5 . **No** REPAIR the circuit(s). CLEAR the DTC(s). REPEAT the self-test.
D5 CHECK THE ADJUSTABLE PEDAL POTENTIOMETER	
• Disconnect: Adjustable Pedal Potentiometer C268. • Measure the resistance between adjustable pedal potentiometer C268-2, circuit 8-AL18 (WH/RD), harness side and adjustable pedal potentiometer C268-3, circuit 7-AL18 (YE/RD), harness side; and between adjustable pedal potentiometer C268-2, circuit 8-AL18 (WH/RD), harness side and adjustable pedal potentiometer C268-1, circuit 9-AL18 (BN/RD) harness side.  N0002876 • **Are the resistances between 3,700 ohms and 5,400 ohms?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTC(s). REPEAT the self-test. **No** INSTALL a new adjustable pedal motor. CLEAR the DTC(s). REPEAT the self-test.

Pinpoint Test E: Vibration When The Brakes Are Applied

Possible Causes

- Uneven brake pad wear
- Brake disc pad transfer
- Brake disc
- Suspension components

PINPOINT TEST E: VIBRATION WHEN THE BRAKES ARE APPLIED

Test Step	Result / Action to Take
E1 CHECK THE OASIS AND FOR TSBs	
• Check the On-Line Automotive Service Information System (OASIS) and Technical Service Bulletins (TSBs) for applicable brake concerns. • **Is there applicable information available on the OASIS or in a TSB?**	**Yes** REFER to the OASIS or the TSB. CARRY OUT any necessary repairs that are indicated by the OASIS or the TSB. If the concern is still present, GO to E2 . **No** GO to E2 .
E2 ROAD TEST THE VEHICLE — LIGHT BRAKING	
• Inspect the wheels and tires. Refer to Section 204-04 . • Road test the vehicle. Warm the brakes by slowing the vehicle from 80 to 32 km/h (50 to 20 mph) using light brake force. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using light pedal force. • **Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?**	**Yes** GO to E5 . **No** GO to E3 .
E3 ROAD TEST THE VEHICLE — MODERATE TO HEAVY BRAKING	
• Road test the vehicle. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force. • **Is there a vibration/shudder?**	**Yes** GO to E4 . **No** The concern is not present at this time.
E4 NORMAL ACTUATION OF THE anti-lock braking system (ABS) SYSTEM DIAGNOSIS	
• During moderate to heavy braking, noise from the hydraulic control unit (HCU) and pulsation in the brake pedal can be noted. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps or wet or snowy surfaces is acceptable and indicates correct functioning of the ABS. Pedal pulsation or steering wheel nibble (frequency is proportioned to the vehicle speed) indicates a concern with a brake or suspension component. • **Is the vibration/shudder vehicle speed sensitive?**	**Yes** GO to E6 . **No** The concern is not present at this time.
E5 APPLICATION OF THE PARKING BRAKE	
• This test is not applicable to vehicles with drum-in-hat type parking brakes. For vehicles with drum-in-hat parking brakes, proceed to the next test step. For all other vehicles, apply the parking brake to identify if the problem is in the front or rear brake. At highway speeds of 89-97 km/h (55-60 mph), lightly	**Yes** GO to E8 . **No** GO to E6 .

apply the parking brake until the vehicle slows down. Release the parking brake immediately after the test. • **Is there a vibration/shudder?**	
E6 CHECK THE FRONT SUSPENSION	
• Check the front suspension. Refer to Section 204-01 . • **Are all the suspension components in satisfactory condition?**	**Yes** GO to E7 . **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
E7 RESURFACE THE FRONT BRAKE DISCS	
• ⚠ **CAUTION: Do not use a bench lathe to machine the brake discs.** • **NOTE:** Follow the manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification. • Resurface the front brake discs. Refer to Brake Disc Machining in this section. • Road test the vehicle. • **Is the vibration/shudder present?**	**Yes** GO to E8 . **No** The concern has been corrected and is not present at this time. No additional repairs necessary.
E8 CHECK THE REAR SUSPENSION	
• Check the rear suspension. Refer to Section 204-02 . • **Are all the suspension components in satisfactory condition?**	**Yes** GO to E9 . **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
E9 RESURFACE THE REAR BRAKE DISC	
• ⚠ **CAUTION: Do not use a bench lathe to machine the brake discs.** • **NOTE:** Follow the manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification. • Resurface the rear brake discs. Refer to Brake Disc Machining in this section. • Road test the vehicle. • **Is the vibration/shudder present?**	**Yes** REFER to Section 100-04 to continue diagnosis of the vibration. **No** The concern has been corrected and is not present at this time. No additional repairs necessary.

Component Tests

Brake Booster

1. Check the hydraulic brake system for leaks or insufficient fluid.

2. With the transmission in NEUTRAL, stop the engine and apply the parking brake control. Apply the brake pedal several times to exhaust all vacuum in the system.

3. Apply the brake pedal and hold it in the applied position. Start the engine. If the vacuum system is operating, the brake pedal tends to move downward under constant foot pressure.

4. If downward movement of the brake pedal is felt, the brake booster is functioning. If no downward movement of the brake pedal is felt, install a new brake booster.

5. Operate the engine a minimum of 10 seconds at fast idle. Stop the engine, and let the vehicle stand for 10 minutes. Then apply the brake pedal with approximately 89 N (20 lb) of force. The brake pedal feel should be the same as that noted with the engine operating. If the brake pedal feels hard (no power assist), install a new brake booster vacuum hose assembly and retest. If the brake pedal feels spongy, bleed the hydraulic system to remove air. Refer to Brake System Bleeding in this section.

Check Valve

The function of the check valve is to allow manifold vacuum to enter the brake booster and prevent the escape of vacuum if manifold vacuum is lost during sustained full throttle operation. The check valve is located inside the aspirator in the brake booster vacuum hose.

To test the function of the check valve:

- Start and run the engine for at least 10 seconds.
- Operate the brake pedal to check for power assist.
- Disconnect the vacuum booster hose from the engine port.
- There should be enough vacuum retained in the brake booster for at least one more power-assisted brake operation.

Brake Master Cylinder — Bypass Condition Test

1. Disconnect the brake lines at the brake master cylinder.

2. Plug the outlet ports of the brake master cylinder.

3. Apply the brakes. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and must be rebuilt or a new master cylinder must be installed.

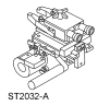
Compensator Port Check

The purpose of the compensator ports in the brake master cylinder is to supply any additional brake fluid required by the system due to brake pad wear and to allow brake fluid returning from the brake lines to the brake master cylinder to enter the brake master cylinder reservoir.

The returning brake fluid causes a slight turbulence in the brake master cylinder reservoir. Turbulence seen in the brake master cylinder reservoir upon application or release of the brake pedal is normal and shows that the compensating ports are not plugged.

Brake Disc Machining

Special Tool(s)

 ST2032-A	On-Car Brake Lathe 201-00002 or equivalent

Material

Item	Specification
High Temperature Nickel Anti-Sieze Lubricant XL-2	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—

Brake Disc Machining

⚠ **CAUTION: Do not use a bench lathe to machine the brake discs.**

NOTE: Read the entire operating manual and view the video shipped with the lathe before installing, operating or repairing the lathe.

NOTE: If the thickness of the brake disc is less than the minimum thickness to machine specification, install a new brake disc. This makes sure that the brake disc thickness is above the minimum thickness after machining.

NOTE: Do not machine new brake discs.

NOTE: Lateral runout and disc thickness variation measurements are not required because correct adjustment of the on-vehicle brake lathe makes sure that these dimensions are within specifications.

1. **NOTE:** It is not necessary to disconnect the brake line from the brake caliper.

   Position the brake caliper and brake caliper anchor bracket aside. For additional information, refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.

2. For vehicles with a 2-piece brake disc and hub assembly:
   1. Mark the brake disc and the wheel stud for correct indexing during re-assembly.
   2. Remove the brake disc from the hub.
   3. ⚠ **CAUTION: Do not use an abrasive sanding disc since it removes paint or other protective finishes from the wheel or metal from the mounting surfaces, adversely affecting corrosion protection and brake disc lateral runout.**

      Remove corrosion from the wheel mounting surface, both disc mounting surfaces and hub mounting surface.
   4. Align the match marks and install the brake disc on the hub.

3. Machine the brake disc using an on-car brake lathe.
    1. Install the hub adapter and silencer belt, if necessary.
    2. Install the cutting lathe.
    3. If lathe is not self adjusting, adjust the lathe oscillation using a dial indicator. Total indicated reading (TIR) target is 0.000 mm (0.000 in), maximum is 0.08 mm (0.003 in).
    4. Center the cutting head, adjust the cutting bits, and install the chip deflector.
    5. **NOTE:** The depth of cut should be between 0.10 and 0.20 mm (0.004 and 0.008 in). Lighter cuts causes the bit to heat up and wear faster. Heavier cuts causes poor brake disc surface finish.

       Machine the brake disc.
    6. Remove the lathe and, if installed, the silencer belt.
    7. Remove the hub adapter.

4. Remove metal shavings.

5. For vehicles with a 2-piece brake disc and hub assembly:
    1. Remove the brake disc from the hub.
    2. Remove metal shavings from the hub, the brake disc mounting surfaces and from the ABS sensors.
    3. Apply anti-seize lubricant to hub mounting surface to prevent corrosion.
    4. Align the match marks and install the brake disc on the hub.

6. **NOTE:** It is not required to install new brake pads if friction material properties are within guidelines. Refer to Brake Pads in this section.

   Install the brake caliper and brake caliper anchor bracket. For additional information, refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.

Brake System Bleeding

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Manual

⚠ WARNING: Use of any other than approved DOT 3 or DOT 4 brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

⚠ CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with the specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with the specified brake fluid.

2. Remove the bleeder screw cap and place a box end wrench on the RH rear bleeder screw. Attach a rubber drain tube to the RH rear bleeder screw and submerge the free end of the tube in a container partially filled with clean brake fluid.

3. Have an assistant hold firm pressure on the brake pedal.

4. Loosen the RH rear bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the RH rear bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.

5. Tighten the RH rear bleeder screw and install the bleeder screw cap.
   - Tighten to 20 Nm (15 lb-ft).

6. Repeat Steps 2-5 for the LH rear bleeder screw.

7. Remove the bleeder screw cap and place a box end wrench on the RH front disc brake caliper bleeder screw. Attach a rubber drain tube to the RH front disc brake caliper bleeder screw, and submerge the free end of the tube in a container partially filled with clean brake fluid.

8. Have an assistant hold firm pressure on the brake pedal.

9. Loosen the RH front disc brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the RH front disc brake caliper bleeder screw.
    - Repeat until clear, bubble-free fluid comes out.
    - Refill the brake master cylinder reservoir as necessary.

10. Tighten the RH front disc brake caliper bleeder screw and install the bleeder screw cap.
    - Tighten to 13 Nm (10 lb-ft).

11. Repeat Steps 7-10 for the LH front disc brake caliper bleeder screw.

Pressure

⚠ WARNING: Use of any other than approved DOT 3 or DOT 4 brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

⚠ CAUTION: Do not allow the master cylinder to run dry during the bleeding operation. Keep the master cylinder reservoir filled with the specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

1. Clean all dirt from and remove the brake master cylinder filler cap. Fill the brake master cylinder reservoir with the specified brake fluid.

2. **NOTE:** Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the instructions of the manufacturer when installing the adapter.

   Install the bleeder adapter to the brake master cylinder reservoir, and attach the bleeder tank hose to the fitting on the adapter.

3. **NOTE:** Bleed the longest line first. Make sure the bleeder tank contains enough specified brake fluid to complete the bleeding operation.

   Remove the bleeder screw cap and place a box end wrench on the RH rear brake caliper bleeder screw. Attach a rubber drain tube to the RH rear brake caliper bleeder screw, and submerge the free end of the tube in a container partially filled with clean brake fluid.

4. Open the valve on the bleeder tank.

5. Loosen the RH rear brake caliper bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RH rear brake caliper bleeder screw and remove the rubber hose and install the bleeder screw cap.
    - Tighten to 20 Nm (15 lb-ft).

6. Continue bleeding the rear of the system, going in order from the LH rear brake caliper bleeder screw to the RH front disc brake caliper bleeder screw ending with the LH front disc brake caliper bleeder screw.

7. Tighten the front brake caliper bleeder screw and remove the hose.
    - Tighten to 13 Nm (10 lb-ft).

8. Close the bleeder tank valve. Remove the tank hose from the adapter, and remove the adapter.

Brake System Leak Check

1. **NOTE:** Brake fluid is water soluble and it is possible that all evidence of fluid leakage has been washed off if the vehicle has been operated in the rain or snow.

   Make sure the brake master cylinder reservoir is full.

2. Apply the brakes several times and make sure the brake pedal feel is not spongy. If necessary, bleed the system. For additional information, refer to Brake System Bleeding in this section.

3. Verify that the reservoir level is not dropping.

4. If the reservoir level is dropping, inspect the brake components, fittings and lines to locate the source of the leak.

General Specifications

Item	Specification
Brake Pads	
Brake pad minimum thickness	3.0 mm (0.118 inch)
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 inch)
Brake Disc	
Brake disc minimum thickness	28.0 mm (1.102 inch)
Lubricant	
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—

Torque Specifications

Description	Nm	lb-ft
Bleeder screw	13	10
Brake caliper flow bolt	47	35
Brake caliper bolts	35	26
Brake caliper anchor plate bolts	103	76

Front Disc Brake

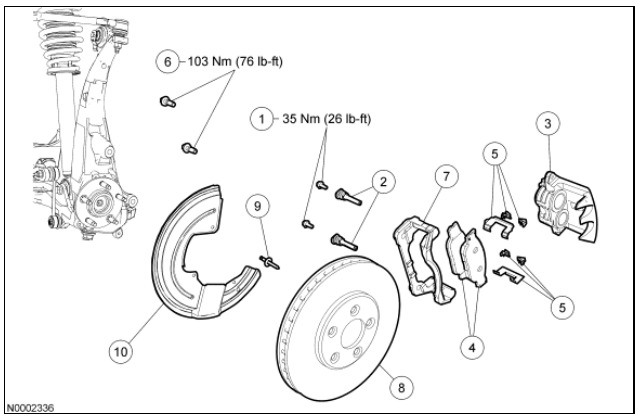
Front Disc Brake

The front disc brake system includes the brake caliper, the disc brake pads, the anchor plate and the brake disc. The brake caliper is a dual piston floating design. The brake caliper is mounted to the anchor plate by the caliper guide bolts. The brake caliper slides, or floats, on the caliper guide bolts. The brake disc is a cast, ventilated type disc. When mechanical force is applied by the driver to the brake pedal, the force is converted into hydraulic pressure by the master cylinder. The hydraulic force is directed to the disc brake calipers and transferred to the brake pads. The brake pads are then forced against the brake disc friction surfaces by the brake caliper pistons. The friction of the brake pads on the brake disc causes the slowing of wheel rotation and the vehicle.

Front Disc Brake

Refer to Section 206-00 .

Disc Brake System — Exploded View



Item	Part Number	Description
1	—	Brake caliper bolts (part of 2N386) (2 required)
2	2N386	Brake caliper guide pin and boots (2 required)
3	2B120	Brake caliper (RH/LH)
4	2001	Brake pads
5	2L200	Spring clips (6 required)
6	W706921	Brake caliper anchor plate bolts (2 required)
7	2B292	Brake caliper anchor plate (RH/LH)
8	1125	Brake disc
9	W701950	Rivet (3 required)
10	2C208	Brake disc shield

1. For additional information, refer to the procedures in this section.

Brake Pads

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A

Removal

⚠ WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **⚠ CAUTION: Do not allow the caliper to hang from the brake hose or damage to the hose can occur.**

   Remove the 2 brake caliper bolts and position the caliper aside.

   - Support the caliper with mechanic's wire.

3. Remove the brake pads and the spring clips.

Installation

1. **NOTE:** Use a suitable tool to protect the pistons and the boots.

   Compress the caliper pistons.

2. Install the spring clips and brake pads.

3. Position the brake caliper and install the 2 brake caliper bolts.
   - To install, tighten to 35 Nm (26 lb-ft).

Brake Caliper

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A

Removal

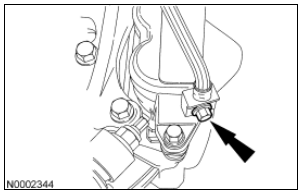
⚠ WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the brake caliper flow bolt and discard the 2 copper washers.



3. Remove the 2 brake caliper bolts and the brake caliper.

Installation

1. Position the brake caliper and install the 2 bolts.
   - To install, tighten to 35 Nm (26 lb-ft).

2. Using 2 new copper washers, position the brake flexible hose and install the flow bolt.
   - To install, tighten to 47 Nm (35 lb-ft).

3. Bleed the brake system. For additional information, refer to Section 206-00 .

Brake Caliper Anchor Plate

Removal and Installation

1. Remove the brake pads. For additional information, refer to Brake Pads in this section.

2. Remove and discard the 2 brake caliper anchor plate bolts.
   - To install, tighten to 103 Nm (76 lb-ft).

3. To install, reverse the removal procedure.

Brake Disc

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—

Removal

1. Remove and discard the 2 brake caliper anchor plate bolts and position the brake caliper anchor plate aside.

2. Mark a wheel stud and the corresponding brake disc lug hole.
   - This makes sure that the lowest front brake disc runout is maintained during reassembly.

3. Remove the brake disc.

Installation

1. Clean any rust or foreign material from the brake disc and wheel hub.
   - Use brake parts cleaner to clean the front brake disc and hub surfaces.

2. Apply a thin coat of high temperature nickel anti-seize lubricant to the hub flange.

3. Install the brake disc, aligning the marks on the disc and the wheel stud.

4. Position the brake caliper anchor plate and install 2 new bolts.
   - To install, tighten to 103 Nm (76 lb-ft).

Brake Disc Shield

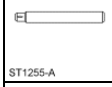
Removal and Installation

1. Remove the brake disc. For additional information, refer to Brake Disc in this section.
2. **CAUTION: Do not use a drill larger than 6.0 mm (0.23 in) to remove the rivet from the brake disc shield.**

   Using a 5.5 mm (0.21 in) drill, remove the 3 rivets.
3. Remove the brake disc shield.
4. To install, reverse the removal procedure.

Brake Caliper

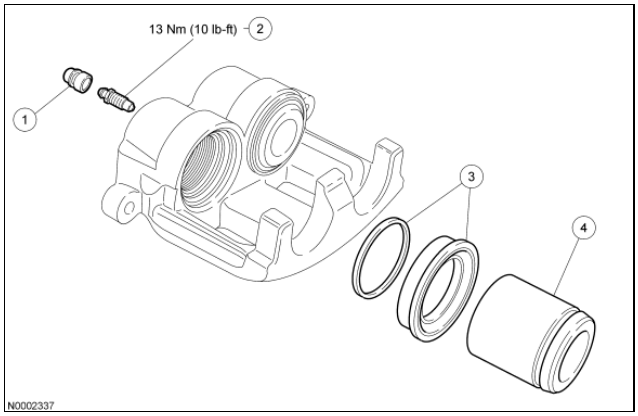
Special Tool(s)

 ST1255-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1588-A	Installer, Rear Wheel Hub Dust Seal 206-053 (T92P-2588-AH)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A

Brake Caliper Exploded View



Item	Part Number	Description
1	2L126	Bleeder screw cap (part of kit 2B294/2B302)
2	2208	Bleeder screw
3	2120	Brake caliper piston seal kit
4	2196	Brake caliper piston

Disassembly

⚠ WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

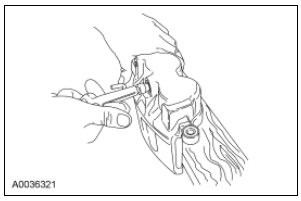
⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products

call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the brake caliper. For additional information, refer to Brake Caliper in this section.
2. Drain the remaining brake fluid from the brake caliper.
3. Secure the brake caliper in a vise.
4. **⚠ CAUTION: Apply moderate air pressure in short bursts to prevent an uncontrolled release of the piston.**

   Place a piece of wood in the caliper. Remove the piston by applying moderate air pressure through the bleeder screw port.



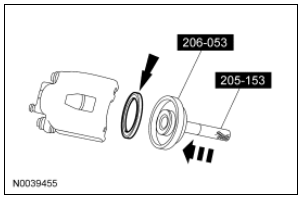
5. **NOTE:** Do not hone the piston bores. If the brake caliper cylinder bore/piston is excessively scored or corroded, install a new brake caliper.

   Remove and discard the piston seal and dust boot.

Assembly

1. **⚠ CAUTION: Never reuse the piston seal or dust boot.**

   Lubricate each cylinder bore, the piston seals, the caliper pistons and the dust boots with brake fluid.
2. Install the piston seals.
3. Use the special tools to install the dust boot.



4. Install the brake caliper piston.
5. Install the brake caliper. For additional information, refer to Brake Caliper in this section.

General Specifications

Item	Specification
Brake Disc	
Brake disc minimum thickness	18.5Â mm (0.728Â inch)
Brake Pads	
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 inch)
Brake pad minimum thickness	3.0 mm (0.118 inch)
Lubricant	
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	ESA-M6C25-A or WSS-M6C62-A
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Bleeder screw	20	15	—
Brake caliper anchor plate bolts	103	76	—
Brake caliper bolts	35	26	—
Brake caliper flow bolt	47	35	—

Rear Disc Brake

The disc brake caliper is held in place using a brake caliper anchor plate bolted to the wheel knuckle. It uses 2 brake caliper guide pins to allow the single piston caliper to move as the disc brake pads wear.

The brake disc is a non-ventilated, full-cast design. The brake disc is removed and installed with the brake caliper and brake caliper anchor plate removed as an assembly.

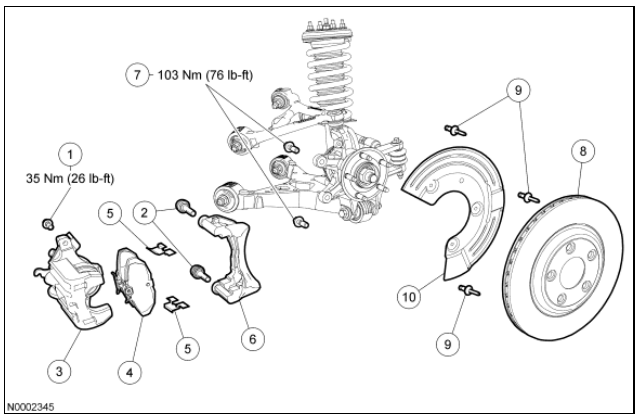
The brake disc shield is mounted to the wheel knuckle and is held in place by the hub and bearing bolts. It protects the wheel bearings and inner surface of the brake disc from damaging road debris.

The disc brake pads are housed in the brake caliper anchor plate assembly and are of a non-asbestos, semi-metallic composition.

Rear Disc Brake

Refer to Section 206-00 .

Disc Brake System — Exploded View



Item	Part Number	Description
1	—	Brake caliper bolt (2 required)
2	2N386	Brake caliper guide pin (2 required)
3	2B120	Brake caliper
4	2200	Brake pads
5	2L200	Spring clips (2 required)
6	2B511	Brake caliper anchor plate
7	—	Brake caliper anchor plate bolts (2 required)
8	1125	Brake disc
9	W701950-S100	Rivets (3 required)
10	2C208	Brake disc shield

1. For additional information, refer to the procedures in this section.

Brake Caliper

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	ESA-M6C25-A or WSS-M6C62-A
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—

Removal

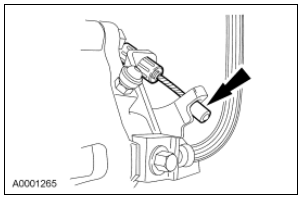
⚠ WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

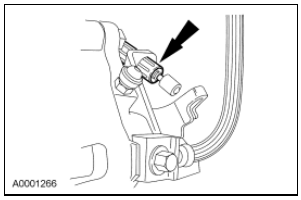
⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

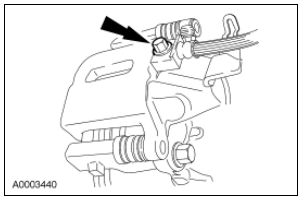
2. Remove the parking brake cable end from the parking brake lever arm.



3. Disconnect the parking brake cable and conduit from the brake caliper.



4. Remove the brake caliper flow bolt and discard the 2 copper washers.



5. Remove the 2 brake caliper bolts.

6. Remove the brake caliper.

7. Inspect the disc brake caliper.
   - If leaks or damaged boots are found, install a new disc brake caliper.

Installation

1. Position the brake caliper and install the 2 bolts.
   - Tighten to 35 Nm (26 lb-ft).

2. Using 2 new copper washers, position the front brake flexible hose and install the flow bolt.
   - Tighten to 47 Nm (35 lb-ft).

3. Connect the parking brake cable and conduit to the brake caliper.

4. Install the parking brake cable end to the parking brake lever arm.

5. Bleed the caliper. For additional information, refer to Section 206-00 .

Brake Pads

Special Tool(s)

ST1112-A	Adapter for Adjuster, Rear Brake Caliper Piston 206-026 (T87P-2588-A) or equivalent

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	ESA-M6C25-A or WSS-M6C62-A

Removal

⚠ WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **⚠ CAUTION: Do not allow the caliper to hang from the brake hose or damage to the hose can occur.**

   ⚠ CAUTION: Care must be used when servicing rear brake components without disconnecting the parking brake cable from the brake caliper lever. Carefully position the caliper aside using a suitable support or damage to the parking brake cable end fittings can occur.

   Remove the 2 brake caliper bolts and position the caliper aside.

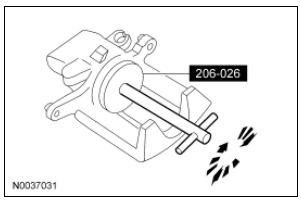
   - Support the caliper with mechanic's wire.

3. Remove the pads and spring clip.
   - Discard the spring clips.

4. Inspect the pads for wear and contamination.

Installation

1. Using the special tool, compress the brake caliper piston into the disc brake caliper.



2. Position the notch in the caliper piston up and down to align with the alignment pin on the brake pad.

3. Install the new spring clips and brake pads.

4. Position the brake caliper and install the 2 bolts.
    - Tighten to 35 Nm (26 lb-ft).

Brake Disc

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the 2 brake caliper anchor plate bolts.

3. **⚠ CAUTION: Using a suitable tool, support the brake caliper and brake caliper anchor plate to the vehicle.**

   ⚠ CAUTION: Care must be used when servicing rear brake components without disconnecting the parking brake cable from the brake caliper lever. Carefully position the caliper aside using a suitable support or damage to the parking brake cable end fittings can occur.

   Position the brake caliper anchor plate and brake caliper assembly aside.

4. Measure the brake disc thickness and install a new brake disc if it is not within specification.

5. Inspect the disc brake caliper and install a new one as required.

Installation

1. Clean any rust or debris from the brake disc and the wheel hub.
   - Use brake parts cleaner to clean the brake disc and hub surfaces.

2. **⚠ CAUTION: Do not allow the lubricant to make contact with the wheel studs, brake pads, or brake disc.**

   Apply a thin coat of anti-seize lubricant to the hub flange.

3. Position the brake caliper and brake caliper anchor plate assembly and install the 2 bolts.
   - Tighten to 103 Nm (76 lb-ft).

4. Test the brakes for normal operation.

Brake Caliper Support Bracket

Material

Item	Specification
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the brake pads. For additional information, refer to Brake Pads in this section.

3. Remove the 2 bolts and the brake caliper anchor plate.
   - Tighten to 103 Nm (76 lb-ft).

4. To install, reverse the removal procedure.

Brake Disc Shield

Material

Item	Specification
Penetrating and Lock Lubricant XL-1 (Canada CXC-51-A)	—
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—

Removal and Installation

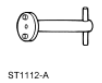
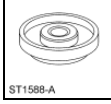
1. Remove the brake disc. For additional information, refer to Brake Disc in this section.
2. **CAUTION: Do not use a drill larger that 6.0 mm (0.23 in) to remove the rivet from the brake disc shield.**

   Remove the brake disc shield rivets.
3. **NOTE:** If the brake disc shield cannot be removed easily, apply rust penetrant and inhibitor on the brake disc to wheel hub mating surfaces.

   Remove the brake disc shield.
4. To install, reverse the removal procedure.

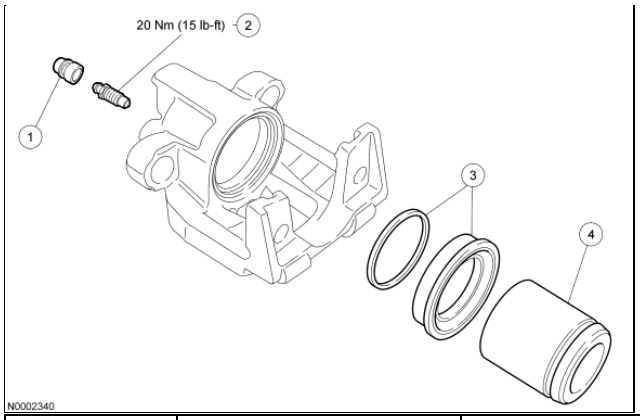
Brake Caliper

Special Tool(s)

 ST1112-A	Adapter for Adjuster, Rear Brake Caliper Piston 206-026 (T87P-2588-A) or equivalent
ST1255-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W) or equivalent
 ST1588-A	Installer, Rear Wheel Hub Dust Seal 206-053 (T92P-2588-AH) or equivalent

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	ESA-M6C25-A or WSS-M6C62-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—



Item	Part Number	Description
1	2L126	Bleeder screw cap
2	378444-S	Bleeder screw
3	2B595	Brake caliper piston seal kit
4	2B588	Brake caliper piston

Disassembly

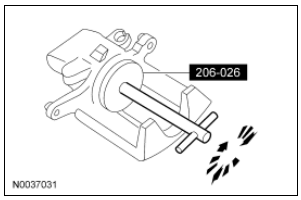
⚠ WARNING: Use of any other than approved DOT 3 or DOT 4 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products

call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

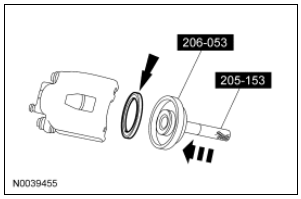
1. Remove the brake caliper. For additional information, refer to Brake Caliper in this section.
2. Drain the remaining brake fluid from the brake caliper.
3. Using the special tool, turn the brake piston counterclockwise.



4. Remove the brake caliper piston and piston seal

Assembly

1. Use the special tools to install the seal.



2. **⚠ CAUTION: Be careful not to damage or dislodge the piston seal.**

   Install the brake piston.

3. Install the brake caliper. For additional information, refer to Brake Caliper in this section.

Torque Specifications

Description	Nm	lb-ft	lb-in
Electronic parking brake (EPB) module nuts	6	—	53
Parking brake cable bracket bolt	20	15	—
EPB actuator assembly bolt	23	17	—

Parking Brake

The electronic parking brake system consist of the following components:

- Electronic parking brake (EPB) module
- EPB switch
- EPB actuator assembly
- RH parking brake cable and conduit
- RH parking brake cable end
- LH parking brake cable and conduit
- LH parking brake cable end

Parking Brake

Refer to Wiring Diagrams Cell 129 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Principles of Operation

Electronic Parking Brake (EPB)

The electronic parking brake (EPB) replaces the function of the conventional hand brake lever system. The EPB has 2 functions. Its primary function is to hold the vehicle up to a 30% grade. The secondary function is to be able to decelerate the vehicle by using the EPB as an emergency brake.

The EPB system:

- has a switch located in the front console behind the gear selector. The switch is hard wired to the EPB module. It includes a yellow fault warning lamp.
- has a control module that communicates with the other vehicle modules through the standard corporate protocol (SCP) network.
- uses an electric motor and gearbox assembly to apply and release tension on a conventional parking brake cable system.

Electronic Parking Brake (EPB) Operation

Pull the parking brake switch upward to engage the parking brake. Release the switch, and it will return to the neutral position. To release the parking brake, make sure the ignition switch is turned to the ON position, press the brake pedal, then push the parking brake switch down. The instrument cluster BRAKE warning lamp will illuminate and will remain illuminated until the parking brake is released.

The EPB will automatically release when the gearshift lever is moved from PARK with the ignition switch in the ON position. The EPB will also disengage if a gear is selected and the accelerator pedal is pressed. The EPB will not release when the release switch is activated. If the battery is disconnected, the EPB system must be reset; the vehicle message center will display APPLY PARK BRAKE or APPLY ((P)).

Electronic Parking Brake (EPB) Resetting

NOTE: The EPB can be released after the battery is reconnected.

The EPB system must be reset whenever the battery has been disconnected or has been in a state of discharge.

To reset the EPB system, follow the steps:

1. Place gearshift selector in the PARK position.
2. Turn the ignition switch to the ON position.
3. Press the brake pedal and at the same time pull on the EPB switch.
4. Release the EPB switch. To release the EPB switch, push on the EPB switch while depressing the brake pedal.

Inspection and Verification

1. Verify the customer concern by operating the EPB system.
2. Visually inspect for obvious signs of mechanical or electrical damage. Refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
• Parking brake cable(s) • Parking brake actuator • Parking brake shoes or related components • Rear brake caliper	• EPB switch • Auxiliary junction box (AJB) fuse 19 (30A) • Central junction box (CJB) fuse 7 (5A) • Connector(s) or connections • Circuitry • EPB module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the diagnostic tool does not power up, refer to the diagnostic tool manual.
5. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP, ISO or UBP circuit faults; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for the EPB module, GO to Pinpoint Test A .
   - System passed, retrieve and record the continuous DTCs and carry out self-test diagnostics for the EPB module.
6. If the DTCs retrieved are related to the concern, go to the Electronic Parking Brake (EPB) System Diagnostic Trouble Code (DTC) Index.
7. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Electronic Parking Brake (EPB) System Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1317	Battery Voltage High	EPB	GO to Pinpoint Test A .
B1318	Battery Voltage Low	EPB	GO to Pinpoint Test A .
B1342	ECU is Defective	EPB	INSTALL a new EPB module. REFER to Parking Brake Module in this section.
B2477	Module Configuration Failure	EPB	**NOTE:** The EPB module is delivered from the manufacturer with this DTC. The EPB module will not operate until it has been configured. CONFIGURE the EPB module. REFER to Section 418-01 .
C1094	Park Brake Apply Switch Circuit Failure	EPB	GO to Pinpoint Test B .
C1408	Parking Brake Release Switch Circuit Out of Range	EPB	GO to Pinpoint Test K .
C1409	Parking Brake Apply Switch Circuit Out of Range	EPB	GO to Pinpoint Test K .
C1769	Park Brake Apply Switch Circuit Short To Ground	EPB	GO to Pinpoint Test C .
C1782	Park Brake Release Switch Circuit Failure	EPB	GO to Pinpoint Test B .
C1783	Park Brake Release Switch Circuit Short to Ground	EPB	GO to Pinpoint Test C .
C1784	EPB Motor Output Short to Ground	EPB	GO to Pinpoint Test D .
C1785	EPB Motor Output Open Circuit	EPB	GO to Pinpoint Test E .
C1786	EPB Motor Output Battery Short to Ground	EPB	GO to Pinpoint Test F .
C1799	Hall-effect Circuit Failure	EPB	GO to Pinpoint Test G .
C1801	Motor Engage Current Reached Before Full Apply Travel Distance	EPB	GO to Pinpoint Test H .
C1802	Motor Engage Current Not Reached or Traveled Too Far Upon Apply	EPB	GO to Pinpoint Test H .
C1803	Motor Disengage Full Travel Distance Not Reached Upon Release	EPB	GO to Pinpoint Test H .
C1987	Yellow Fault Warning Lamp Indicator Short to Voltage	EPB	GO to Pinpoint Test I .
C1988	Yellow Fault Warning Lamp Indicator Circuit Failure	EPB	GO to Pinpoint Test I .
C1989	Parking Brake Apply and Release Switch Contacts Energized Simultaneously	EPB	GO to Pinpoint Test J .
U1027		EPB	GO to Pinpoint Test L .

	SCP Invalid or Missing Data for Engine RPM		
U1040	SCP Invalid or Missing Data for Vehicle Speed	EPB	GO to Pinpoint Test L .
U1051	SCP Invalid or Missing Data for Brakes	EPB	GO to Pinpoint Test L .
U1058	SCP Invalid or Missing Data for Transmission/Transaxle	EPB	GO to Pinpoint Test L .
U1134	SCP Invalid or Missing Data for Ignition Switch/Starter	EPB	GO to Pinpoint Test L .
U1262	SCP Communication Bus Fault	EPB	REFER to Section 418-00 .

Symptom Chart

Symptom Chart
Pinpoint Tests

Pinpoint Test A: DTC B1317/B1318 — Battery Voltage High/Low

Normal Operation

The vehicle electrical system supplies 12 volts to the electronic parking brake (EPB) module.

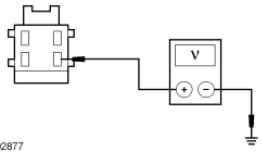
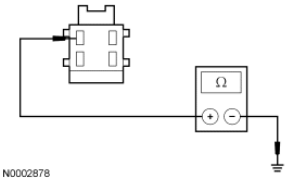
Voltage is supplied by circuit 30-CG16 (RD/BU) (power hot at all times). Ground is supplied by circuit 31-CG16 (BK/BU).

Possible Causes
- Fuse
- Charging system
- Battery
- Circuit 31-CG16 (BK/BU) open
- Circuit 30-CG16 (RD/BU) open

PINPOINT TEST A: DTC B1317/B1318 — BATTERY VOLTAGE HIGH/LOW

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
A1 CHECK THE BATTERY VOLTAGE	
• Measure battery voltage between positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running.	**Yes** GO to A2 . **No** REFER to Section 414-00 . CLEAR the DTC(s). REPEAT the self-test. RESET the EPB system.

• **Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running?**	REFER to Electronic Parking Brake (EPB) Resetting in this section.
A2 CHECK THE VOLTAGE TO THE EPB MODULE	
• Disconnect: EPB Module C4205a. • Measure the voltage between EPB module C4205a-1, circuit 30-CG16 (RD/BU), harness side and ground.  N0002877 • **Is the voltage greater than 10 volts?**	**Yes** GO to A3 . **No** VERIFY auxiliary junction box (AJB) fuse 19 (30A) is OK. If OK, REPAIR circuit 30-CG16 (RD/BU) for an open. CLEAR the DTCs. REPEAT the self-test.
A3 CHECK THE EPB MODULE GROUND	
• Ignition OFF. • Measure the resistance between EPB module C4205a-4, circuit 31-CG16 (BK/BU), harness side and ground.  N0002878 • **Is the resistance less than 5 ohms?**	**Yes** CHECK the module communications network. REFER to Section 418-00 . **No** REPAIR circuit 31-CG16 (BK/BU) for an open. CLEAR the DTC(s). REPEAT the self-test.

Pinpoint Test B: DTC C1094/C1782: Park Brake Apply/Release Switch Circuit Failure

Normal Operation

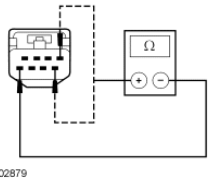
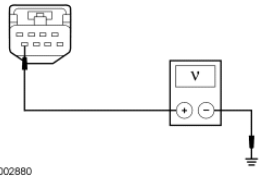
The electronic parking brake (EPB) switch circuits 8-CG15 (WH/BU) and 10-CG15 (GY/VT) receive a reference voltage from the EPB module when the switch is in its neutral position. This voltage is between 3.5 and 4.5 volts. When the switch contacts close on the apply or release side, a resistor inside the switch is bypassed, causing the reference voltage on switch circuits 8-CG15 (WH/BU) or 10-CG15 (GY/VT) to change from 1.5 to 3.0 volts. When the EPB module receives this voltage range on the apply or release circuit, an output signal is generated to the actuator to apply or release the EPB.

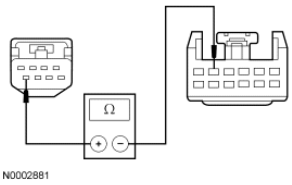
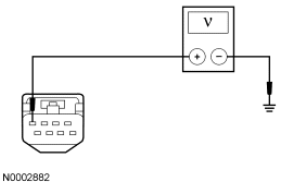
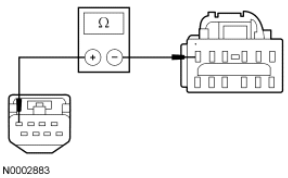
Possible Causes

- EPB switch
- Circuit 8-CG15 (WH/BU) open or short to voltage
- Circuit 10-CG15 (GY/VT) open or short to voltage
- EPB module

PINPOINT TEST B: DTC C1094/C1782: PARK BRAKE APPLY/RELEASE SWITCH CIRCUIT FAILURE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
B1 CHECK THE ELECTRONIC PARKING BRAKE (EPB) SWITCH	
• Disconnect the battery. Refer to Section 414-00 . • Disconnect: EPB Switch C3218. • Measure the resistance between EPB switch C3218 pin 8, component side and C3218 pin 5, component side while EPB switch is in the idle position; and between EPB switch C3218 pin 4, component side and C3218 pin 5, component side while EPB switch is in the idle position.  N0002879 • Measure the resistance between EPB switch C3218 pin 8, component side and C3218 pin 5, component side while EPB switch is in the apply position; and between EPB switch C3218 pin 4, component side and C3218 pin 5, component side while EPB switch is in the release position. • **Is the resistance between 149 - 153 ohms in the apply position and between 597 - 609 ohms in the idle position?**	**Yes** GO to B2 . **No** INSTALL a new parking brake. REFER to Parking Brake Switch in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
B2 CHECK CIRCUIT 8-CG15 (WH/BU) FOR A SHORT TO VOLTAGE	
• Measure the voltage between EPB switch C3218-8, circuit 8-CG15 (WH/BU), harness side and ground.  N0002880 • **Is battery voltage present?**	**Yes** REPAIR circuit 8-CG15 (WH/BU) for a short to voltage. CLEAR the DTCs. RESET the EPB module. REFER to Electronic Parking Brake (EPB) Resetting in this section. REPEAT the self-test. **No** GO to B3 .
B3 CHECK CIRCUIT 8-CG15 (WH/BU) FOR AN OPEN	

• Disconnect: EPB Module C4205b. • Measure the resistance between EPB module C4205b-5, circuit 8-CG15 (WH/BU), harness side and EPB switch C3218-8, circuit 8-CG15 (WH/BU), harness side.  N0002881 • **Is the resistance less than 5 ohms?**	**Yes** GO to B4 . **No** REPAIR circuit 8-CG15 (WH/BU) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
B4 CHECK CIRCUIT 10-CG15 (GY/VT) FOR A SHORT TO VOLTAGE	
• Measure the voltage between EPB switch C3218-4, circuit 10-CG15 (GY/VT), harness side and ground.  N0002882 • **Is battery voltage present?**	**Yes** REPAIR circuit 10-CG15 (GY/VT) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** GO to B5 .
B5 CHECK CIRCUIT 10-CG15 (GY/VT) FOR AN OPEN	
• Measure the resistance between EPB module C4205b-6 circuit 10-CG15 (GY/VT), harness side and EPB switch C3218-4 circuit 10-CG15 (GY/VT), harness side.  N0002883 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new EPB module. REFER to Parking Brake Module in this section. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** REPAIR circuit 10-CG15 (GY/VT) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

Pinpoint Test C: DTC C1769/C1783: Park Brake Apply/Release Switch Circuit Short To Ground

Normal Operation

The electronic parking brake (EPB) switch circuits 8-CG15 (WH/BU) and 10-CG15 (GY/VT) receive a reference voltage from the EPB module when the switch is in its neutral position. This voltage is between 3.5 and 4.5 volts. When the switch contacts close on the apply or release side, a resistor inside the switch is

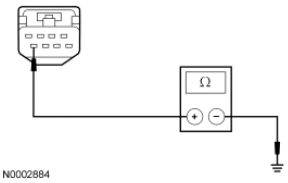
shorted, causing the voltage on switch circuits 8-CG15 (WH/BU) or 10-CG15 (GY/VT) to change from 1.5 to 3.0 volts. When the EPB module receives this voltage range on the apply or release circuit, an output signal is generated to the actuator to apply or release the EPB.

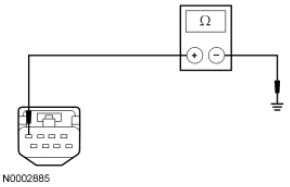
Possible Causes

- Circuit 8-CG15 (WH/BU) short to ground
- Circuit 10-CG15 (GY/VT) short to ground
- EPB module
- EPB switch

PINPOINT TEST C: DTC C1769/C1783: PARK BRAKE APPLY/RELEASE SWITCH SHORT TO GROUND

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
C1 RETRIEVE THE DTCs	
• Connect the scan tool. • Enter the following diagnostic mode on the scan tool: Retrieve the DTC(s). • **Is DTC C1769 retrieved?**	**Yes** GO to C2 . **No** If DTC C1783 is retrieved, GO to C3 .
C2 CHECK CIRCUIT 8-CG15 (WH/BU) FOR AN OPEN	
• Disconnect the battery. Refer to Section 414-00 . • Disconnect: EPB Switch C3218. • Measure the resistance between electronic parking brake (EPB) switch C3218-8, circuit 8-CG15 (WH/BU), harness side and ground.  N0002884 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C3 . **No** REPAIR circuit 8-CG15 (WH/BU) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
C3 CHECK CIRCUIT 10-CG15 (GY/VT) FOR AN OPEN	
• Measure the resistance between the EPB switch C3218-4, circuit 10-CG15 (GY/VT), harness side and ground.	**Yes** GO to C4 . **No** REPAIR circuit 10-CG15 (GY/VT) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

 N0002885 • **Is the resistance greater than 10,000 ohms?**	
C4 CHECK THE EPB SWITCH PIDs	
• Using the diagnostic tool, monitor the EPB apply, neutral, and release PIDs while operating the EPB switch. • **Do the EPB PIDs match the EPB switch positions?**	**Yes** INSTALL a new EPB module. REFER to Parking Brake Module in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** INSTALL a new EPB switch. REFER to Parking Brake Switch in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

Pinpoint Test D: DTC C1784: Electronic Parking Brake (EPB) Motor Output Short To Ground

Normal Operation

The electronic parking brake (EPB) 2-way motor receives power from circuit 32-CG19 (WH/VT) or 33-CG19 (YE/VT), depending the direction of the motor revolution. When the EPB is applied, circuit 32-CG19 (WH/VT) is equal to the battery voltage and circuit 33-CG19 (YE/VT) is equal to 0 volts. When the EPB is released, 32-CR19 (YE/VT) is equal to 0 volts and 33-CT19 (YE/VT) is equal to the battery voltage. Otherwise, both circuits are at one half of the battery voltage.

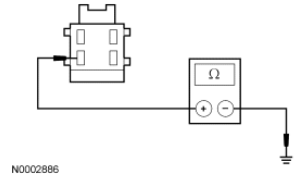
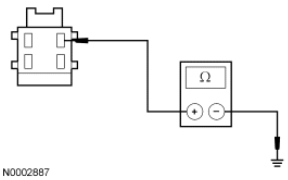
Possible Causes

- Circuit 32-CG19 (WH/VT) short to ground
- Circuit 33-CG19 (YE/VT) short to ground
- EPB module
- EPB switch
- EPB actuator

PINPOINT TEST D: C1784: ELECTRONIC PARKING BRAKE (EPB) MOTOR OUTPUT CIRCUIT SHORT TO GROUND

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
D1 CHECK CIRCUIT 32-CG19 (WH/VT) FOR A SHORT TO GROUND	

• Disconnect the battery. Refer to Section 414-00 . • Disconnect: EPB Module C4205a. • Measure the resistance between EPB module C4205a-3 circuit 32-CG19 (WH/VT), harness side and ground.  N0002886 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D2 . **No** REPAIR circuit 32-CG19 (WH/VT) for a short to ground. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
D2 CHECK CIRCUIT 33-CG19 (YE/VT) FOR A SHORT TO GROUND	
• Measure the resistance between EPB module C4205a-2, circuit 33-CG19 (YE/VT), harness side and ground.  N0002887 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new EPB module. REFER to Parking Brake Module in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** REPAIR circuit 33-CG19 (YE/VT) for a short to ground. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

Pinpoint Test E: DTC C1785: Electronic Parking Brake (EPB) Motor Output Open Circuit

Normal Operation

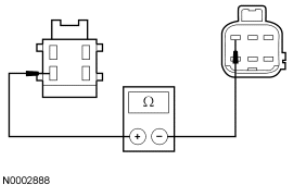
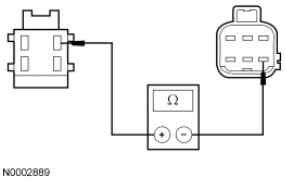
The electronic parking brake (EPB) 2-way motor receives power from circuit 32-CG19 (WH/VT) or 33-CG19 (YE/VT), depending on the direction of the motor revolution. When the EPB is applied, circuit 32-CG19 (WH/VT) is equal to the battery voltage and circuit 33-CG19 (YE/VT) is equal to 0 volts. When the EPB is released, 32-CR19 (YE/VT) is equal to 0 volts and 33-CT19 (YE/VT) is equal to the battery voltage. Otherwise, both circuits are at one half of the battery voltage.

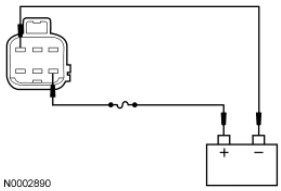
Possible Causes

- Circuit 32-CG19 (WH/VT) open
- Circuit 33-CG19 (YE/VT) open
- EPB actuator
- EPB module

PINPOINT TEST E: DTC C1785: ELECTRONIC PARKING BRAKE (EPB) MOTOR OUTPUT OPEN CIRCUIT

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
E1 CHECK CIRCUIT 32-CG19 (WH/VT) FOR AN OPEN	
• Disconnect the battery. Refer to Section 414-00 . • Disconnect: EPB Module C4205a. • Disconnect: EPB Actuator C4206. • Measure the resistance between EPB module C4205a-3, circuit 32-CG19 (WH/VT), harness side and EPB actuator C4206-1, circuit 32-CG19 (WH/VT), harness side.  N0002888 • **Is the resistance less than 5 ohms?**	**Yes** GO to E2 . **No** REPAIR circuit 32-CG19 (WH/VT) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
E2 CHECK CIRCUIT 33-CG19 (YE/VT) FOR AN OPEN	
• Measure the resistance between EPB module C4205a-2, circuit 33-CG19 (YE/VT), harness side and EPB actuator C4206-6, circuit 33-CG19 (YE/VT), harness side.  N0002889 • **Is the resistance less than 5 ohms?**	**Yes** GO to E3 . **No** REPAIR circuit 33-CG19 (YE/VT) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
E3 CHECK THE EPB ACTUATOR INTEGRITY	
• Connect a fused (10A) jumper wire to EPB actuator C4206 pin 6, circuit 33-CG19 (YE/VT), component side and to the positive battery terminal.	**Yes** INSTALL a new EPB module. REFER to Parking Brake Module in this section. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. REPEAT the self-test. TEST the system for normal operation. **No** INSTALL a new EPB actuator. REFER to

 • Connect a fused (10A) jumper wire to EPB actuator C4206 pin 1, circuit 32-CG19 (WH/VT), component side and to the negative battery terminal. • Reverse the leads to verify the actuator operates in both directions. • **Does the EPB actuator operate in both directions?**	Parking Brake Actuator in this section. CLEAR the DTCs. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test F: DTC C1786: Electronic Parking Brake (EPB) Motor Output Circuit Short To Voltage

Normal Operation

The electronic parking brake (EPB) 2-way motor receives power from circuit 32-CG19 (WH/VT) or 33-CG19 (YE/VT), depending on the direction of the motor revolution. When the EPB is applied, circuit 32-CG19 (WH/VT) is equal to battery voltage and circuit 33-CG19 (YE/VT) is equal to 0 volts. When the EPB is released, 32-CR19 (YE/VT) is equal to 0 volts and 33-CT19 (YE/VT) is equal to battery voltage. Otherwise both circuits are at one half of the battery voltage.

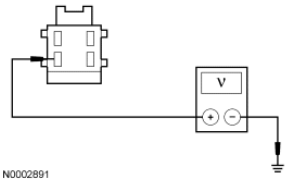
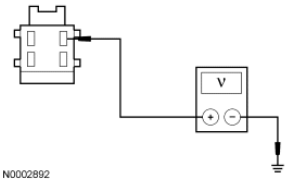
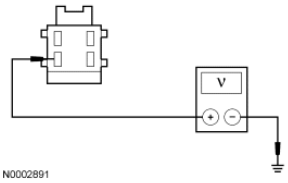
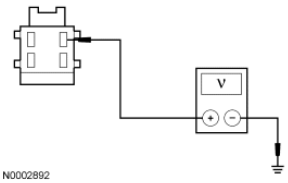
Possible Causes

- Circuit 32-CG19 (WH/VT) short to voltage
- Circuit 33-CG19 (YE/VT) short to voltage
- EPB actuator
- EPB module

PINPOINT TEST F: DTC C1786: EPB MOTOR OUTPUT CIRCUIT SHORT TO VOLTAGE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
F1 CHECK CIRCUIT 32-CG19 (WH/VT) FOR A SHORT TO VOLTAGE	
• Disconnect: EPB Module C4205a. • Disconnect: EPB Actuator C4206. • Measure the voltage between EPB module C4205a-3, circuit 32-CG19 (WH/VT), harness side and ground.	**Yes** REPAIR circuit 32-CG19 (WH/VT) for a short to ground. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** GO to F2 .

 N0002891 • **Is voltage present?**	
F2 CHECK CIRCUIT 33-CG19 (YE/VT) FOR A SHORT TO VOLTAGE	
• Measure the voltage between EPB module C4205a-2, circuit 33-CG19 (YE/VT), harness side and ground.  N0002892 • **Is voltage present?**	**Yes** REPAIR circuit 33-CG19 (YE/VT) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** GO to F3 .
F3 CHECK THE EPB ACTUATOR MOTOR (+)	
• Connect: EPB Actuator C4206. • Measure the voltage between EPB module C4205a-3, circuit 32-CG19 (WH/VT), harness side and ground.  N0002891 • **Is voltage present?**	**Yes** INSTALL a new EPB actuator. REFER to Parking Brake Actuator in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** GO to F4 .
F4 CHECK THE EPB ACTUATOR MOTOR (-)	
• Measure the voltage between EPB module C4205a-2, circuit 33-CG19 (YE/VT), harness side and ground.  N0002892 • **Is voltage present?**	**Yes** INSTALL a new EPB actuator. REFER to Parking Brake Actuator in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** INSTALL a new EPB module. REFER to Parking Brake Module in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

Pinpoint Test G: DTC C1799: Electronic Parking Brake (EPB) Hall-Effect Circuit Failure

Normal Operation

The electronic parking brake (EPB) actuator contains a Hall-effect sensor, which the EPB module uses to determine how long the EPB motor is required to run during an application or release of the parking brake. The Hall-effect sensor receives power (approximately 2 volts less than the battery voltage) from the EPB module through circuit 7-CG20 (YE/VT). Circuit 8-CG20 (WH/VT) provides a signal to the EPB module and this signal varies between 0 and 4.4 volts when the EPB motor is rotating. The voltage varies due to the presence of a magnetic field, which is being detected by the Hall-effect sensor. Ground to the Hall-effect sensor is supplied by circuit 9-CG20 (BN/VT).

Possible Causes

- Circuit 7-CG20 (YE/VT) short to voltage, short to ground, or open
- Circuit 8-CG20 (WH/VT) short to voltage, short to ground, or open
- Circuit 9-CG20 (BN/VT) short to voltage, short to ground, or open
- EPB actuator
- EPB module

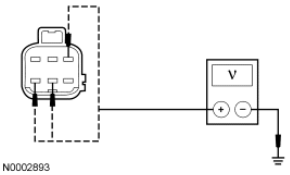
PINPOINT TEST G: DTC C1799: ELECTRONIC PARKING BRAKE (EPB) HALL CIRCUIT EFFECT FAILURE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>G1 CHECK THE HALL-EFFECT CIRCUITS FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>• Disconnect: EPB Module C4205b.
• Disconnect: EPB Actuator C4206.
• Measure the voltage between EPB actuator C4206 circuits, harness side and ground as follows:

<table><tr><th>Circuit</th><th>Pin</th><th>Function</th></tr><tr><td>7-CG20 (YE/VT)</td><td>3</td><td>Hall-effect voltage</td></tr><tr><td>8-CG20 (WH/VT)</td><td>4</td><td>Hall-effect signal</td></tr><tr><td>9-CG20 (BN/WH)</td><td>5</td><td>Hall-effect ground</td></tr></table></td><td>Yes
REPAIR the affected circuit(s) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

No
GO to G2 .</td></tr>
</table>

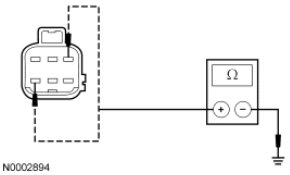


- **Is any voltage present?**

G2 CHECK THE HALL-EFFECT CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between EPB actuator C4206 circuits, harness side and ground as follows:

Circuit	Pin	Function
7-CG20 (YE/VT)	3	Hall-effect voltage
8-CG20 (WH/VT)	4	Hall-effect signal



- **Are the resistances greater than 10,000 ohms?**

Yes
GO to G3 .

No
REPAIR the affected circuit(s) for a short to ground. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

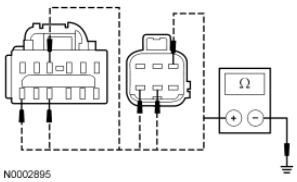
G3 CHECK THE HALL-EFFECT CIRCUITS FOR AN OPEN

- Measure the resistance between EPB actuator C4206 circuits, harness side and EPB module C4205b circuits, harness side as follows:

Circuit	EPB Actuator Pin	EPB Module Pin
7-CG20 (YE/VT)	3	10
8-CG20 (WH/VT)	4	4
9-CG20 (BN/WH)	5	12

Yes
GO to G4 .

No
REPAIR the affected circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

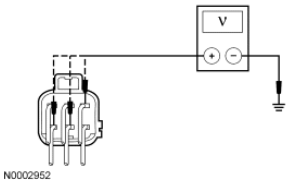


- **Is the resistance less than 5 ohms?**

G4 CHECK THE HALL-EFFECT CIRCUITS FOR A SHORT TO VOLTAGE WITH THE EBP ACTUATOR CONNECTED

- Connect: EPB Actuator C4206.
- Measure the voltage between EPB actuator C4206 circuits, harness side and ground as follows:

Circuit	Pin	Function
7-CG20 (YE/VT)	3	Hall-effect voltage
8-CG20 (WH/VT)	4	Hall-effect signal
9-CG20 (BN/WH)	5	Hall-effect ground



- **Is any voltage present?**

Yes
INSTALL a new EPB actuator. REFER to Parking Brake Actuator in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

No
GO to G5 .

G5 CHECK THE HALL-EFFECT CIRCUITS FOR A SHORT TO GROUND WITH THE EBP ACTUATOR CONNECTED

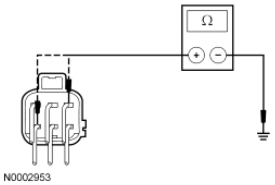
- Measure the resistance between EPB actuator C4206 circuits, harness side and ground as follows:

Circuit	Pin	Function
7-CG20 (YE/VT)	3	Hall-effect voltage

Yes
GO to G6 .

No
INSTALL a new EPB actuator. REFER to Parking Brake Actuator in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

8-CG20 (WH/VT)	4	Hall-effect signal

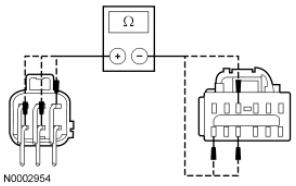


- **Is the resistance greater than 10,000 ohms?**

G6 CHECK THE HALL-EFFECT CIRCUITS FOR AN OPEN WITH THE EBP ACTUATOR CONNECTED

- Measure the resistance between EPB actuator C4206 circuits, harness side and EPB module C4205b circuits, harness side as follows:

Circuit	EPB Actuator Pin	EPB Module Pin
7-CG20 (YE/VT)	3	10
8-CG20 (WH/VT)	4	4
9-CG20 (BN/WH)	5	12



- **Is the resistance less than 5 ohms?**

Yes
INSTALL a new EPB actuator. REFER to Parking Brake Actuator in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

No
REPAIR the affected circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

Pinpoint Test H: DTCS C1801, C1802 AND C1803: Electronic Parking Brake (EPB) Actuator Apply/Release Faults

Normal Operation

The electronic parking brake (EPB) system applies and releases the parking brake cables using an electric motor and gear connected to the parking brake cables. The cable ends are connected to the rear disc brake caliper lever. The lever applies and releases the brake piston toward or away from the rear disc.

Possible Causes

- Parking brake cables
- Rear disc brake caliper
- EPB module

Pinpoint Test I: DTCS C1987/C1988: Yellow Electronic Parking Brake (EPB) Fault Warning Indicator Short To Battery/Circuit Failure

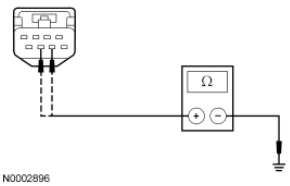
Normal Operation

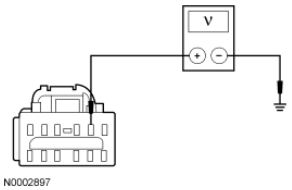
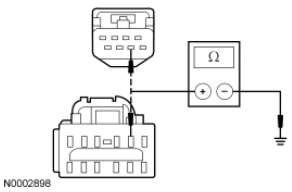
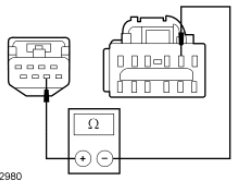
The yellow electronic parking brake (EPB) system warning indicator (in the EPB switch) illuminates for 3 seconds at prove-out when the ignition switch is cycled to RUN, and illuminates continuously, even with the ignition switch OFF, when the EPB module has detected a fault in the system and DTCs are present.

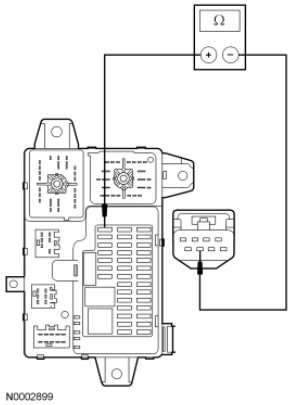
Possible Causes

- EPB module
- EPB switch
- Central junction box (CJB) fuse 7 (5A)
- Circuit 75-CG14 (YE/GN) open
- Circuit 31S-CG14 (BK/GN) open, short to voltage, or short to ground

PINPOINT TEST I: DTCS C1987/C1988: YELLOW ELECTRONIC PARKING BRAKE (EPB) FAULT WARNING INDICATOR SHORT TO BATTERY/CIRCUIT FAILURE

Test Step	Result / Action to Take
I1 CHECK THE EPB SWITCH	
• Disconnect: EPB Switch C3218. • Measure the resistance between EPB switch C3218-6, circuit 31S-CG14 (BK/GN), component side and EPB switch C3218-7, circuit 75-CG14 (YE/GN), component side.  N0002896 • **Is the resistance less than 15 ohms?**	**Yes** GO to I2 . **No** INSTALL a new EPB switch. REFER to Parking Brake Switch in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
I2 CHECK CIRCUIT 31S-CG14 (BK/GN) FOR A SHORT TO VOLTAGE	
• Disconnect: EPB Module C4205b. • Measure the voltage between EPB module C4205b-2, circuit 31S-CG14 (BK/GN), harness side and ground.	**Yes** REPAIR circuit 315-CG14 (BK/GN) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

 N0002897 • **Is voltage present?**	**No** GO to I3 .
I3 CHECK CIRCUIT 31S-CG14 (BK/GN) FOR A SHORT TO GROUND	
• Measure the resistance between EPB module C4205b-2, circuit 31S-CG14 (BK/GN) harness side and ground; and between EPB switch C3218-6, circuit 31S-CG14 (BK/GN), harness side and ground.  N0002898 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I4 **No** REPAIR circuit 315-CG14 (BK/GN) for a short to ground. REPEAT the self-test. CLEAR the DTC(s). RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
I4 CHECK CIRCUIT 31S-CG14 (BK/GN) FOR AN OPEN	
• Disconnect the battery. Refer to Section 414-00 . • Measure the resistance between EPB module C4205b-2, circuit 31S-CG14 (BK/GN), harness side and EPB switch C3218-6, circuit 31S-CG14 (BK/GN), harness side.  N0002980 • **Is the resistance less than 5 ohms?**	**Yes** GO to I5 . **No** REPAIR circuit 315-CG14 (BK/GN) for an open. REPEAT the self-test. CLEAR the DTC(s). RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
I5 CHECK CIRCUIT 75-CG14 (YE/GN) FOR AN OPEN	

• Measure the resistance between EPB switch C3218-7, circuit 75-CG14 (YE/GN), harness side and CJB fuse 7 (5A) output cavity.  N0002899 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new EPB module. REFER to Parking Brake Module in this section. CLEAR the DTC(s). REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** REPAIR circuit 75-CG14 (YE/GN) for an open. CLEAR the DTC(s). REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

Pinpoint Test J: DTC C1989: Park Brake Apply And Release Switch Contacts Energized Simultaneously

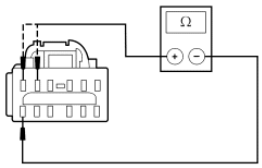
Normal Operation

The electronic parking brake (EPB) 2-way motor receives power from circuit 32-CG19 (WH/VT) or 33-CG19 (YE/VT), depending on the direction of the motor revolution. When the EPB is applied, circuit 32-CG19 (WH/VT) is equal to the battery voltage and circuit 33-CG19 (YE/VT) is equal to 0 volts. When the EPB is released, 32-CR19 (YE/VT) is equal to 0 volts and 33-CT19 (YE/VT) is equal to battery voltage. Otherwise, both circuits are at one half of the battery voltage.

Possible Causes
- 8-CG15 (WH/BU) short
- 10-CG15 (GY/VT) short
- 9-CG20 (BN/WH) short
- EPB switch
- EPB module

PINPOINT TEST J: C1989: PARK BRAKE APPLY AND RELEASE SWITCH CONTACTS ENERGIZED SIMULTANEOUSLY

Test Step	Result / Action to Take
J1 CHECK FOR ELECTRONIC PARKING BRAKE (EPB) PIDs	
• Connect the scan tool. • Using the diagnostic tool, monitor the EPB PIDs when the EPB switch is in its apply, neutral, and release positions. • **Do the EPB PIDs match the EPB switch positions?**	**Yes** GO to J2 . **No** INSTALL a new EPB switch. REFER to Parking Brake Switch in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB)

<table>
<tr><td></td><td>Resetting in this section.</td></tr>
<tr><td>J2 CHECK THE EPB CIRCUITS FOR SHORTED TOGETHER</td><td></td></tr>
<tr><td>
• Disconnect the battery. Refer to Section 414-00 .
• Disconnect: EPB Module C4205b.
• Disconnect: EPB Switch C3218.
• Disconnect: EPB Actuator C4206.
• Check the following EPB module C4205b circuits for a short together as follows:
<table>
<tr><th>Circuit</th><th>Description</th><th>EPB Module Pin</th></tr>
<tr><td>9-CG20 (BN/WH)</td><td>EPB actuator and EPB switch ground</td><td>12</td></tr>
<tr><td>10-CG15 (GY/VT)</td><td>EPB release</td><td>6</td></tr>
<tr><td>8-CG15 (WH/BU)</td><td>EPB apply</td><td>5</td></tr>
</table>


• Are any of the resistances less than 10,000 ohms?
</td><td>
Yes
INSTALL a new EPB module. REFER to Parking Brake Module in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

No
REPAIR the affected circuit(s) for a short. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.
</td></tr>
</table>

Pinpoint Test K: DTC C1408/C1409: Parking Brake Apply/Release Switch Circuit Out Of Range

Normal Operation

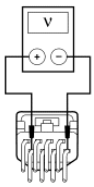
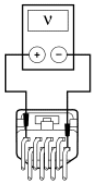
The electronic parking brake (EPB) switch circuits 8-CG15 (WH/BU) and 10-CG15 (GY/VT) receive a reference voltage from the EPB module when the switch is in its neutral position. This voltage is between 3.5 and 4.5 volts. When the switch contacts close on the apply or release side, a resistor inside the switch is shorted, causing the voltage on circuits 8-CG15 (WH/BU) or 10 CG15 (GY/VT) to change from 1.5 to 3.0 volts. When the EPB module receives this voltage range on the apply or release circuit, an output signal is generated to the actuator to apply or release the EPB.

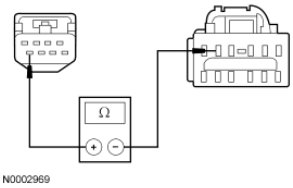
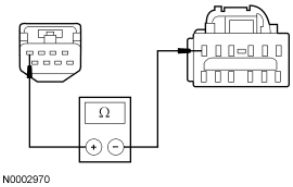
Possible Causes

- EPB switch
- Circuit 8-CG15 (WH/BU) open
- Circuit 10-CG15 (GY/VT) open
- EPB module

PINPOINT TEST K: DTC C1408/C1409: PARKING BRAKE APPLY/RELEASE SWITCH CIRCUIT OUT OF RANGE

NOTE: If DTC C1408 is retrieved, go to Step 1. If DTC C1409 is retrieved, go to Step 2.

Test Step	Result / Action to Take
K1 CHECK THE PARKING BRAKE SWITCH APPLY/RELEASE OUTPUT	
• Measure the voltage between electronic parking brake (EPB) switch C3218-8, circuit 8-CG15 (WH/BU), harness side and EBP switch C3218-5, circuit 9-CG15 (BN/BU), harness side while pulling EPB switch up from its rest position.  N0002955 • Measure the voltage between EPB switch C3218-4, circuit 10-CG15 (GY/VT), harness side and EBP switch C3218-5, circuit 9-CG15 (BN/BU), harness side while pushing EPB switch down from its rest position.  N0002956 • **Do the voltages change from 3.5-4.5 volts (idle range) to 1.5-3.0 volts (switch active range)?**	**Yes** If the EPB switch apply voltage is within range, GO to K2 . If the EPB switch release voltage is within range, GO to K3 . **No** INSTALL a new EPB switch. REFER to Parking Brake Switch in this section. RESET the parking brake system. REFER to Electronic Parking Brake (EPB) Resetting in this section. CLEAR the DTCs. REPEAT the self-test.
K2 CHECK CIRCUIT 8-CG15 (WH/BU) FOR AN OPEN	
• Disconnect the battery. Refer to Section 414-00 . • Disconnect: EPB Switch C3218. • Disconnect: EPB Module C4205b. • Measure the resistance between EPB switch C3218-8, circuit 8-CG15 (WH/BU), harness side and EPB module C4205b-5, circuit 8-CG15 (WH/BU), harness side.	**Yes** INSTALL a new EPB switch. REFER to Parking Brake Switch in this section. RESET the parking brake system. REFER to Electronic Parking Brake (EPB) Resetting in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 8-CG15 (WH/BU) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

 N0002969 • **Is the resistance less than 5 ohms?**	
K3 CHECK CIRCUIT 10-CG15 (GY/VT) FOR AN OPEN	
• Disconnect: EPB Switch C3218. • Disconnect: EPB Module C4205b. • Measure the resistance between EPB switch C3218-4, circuit 10-CG15 (GY/VT), harness side and EPB module C4205b-6, circuit 10-CG15 (GY/VT) harness side.  N0002970 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new EPB module. REFER to Parking Brake Module in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** REPAIR circuit 10-CG15 (GY/VT) for an open. CLEAR the DTCs. REPEAT the self-test. RESET the parking brake system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

Pinpoint Test L: DTCs U1027, U1040, U1051, U1058, and U1134

Normal Operation

The electronic parking brake (EPB) module receives module inputs from the anti-lock brake system (ABS) module, the powertrain control module (PCM), and the instrument cluster through the standard corporate protocol (SCP) network.

Possible Causes
- ABS module
- PCM
- Instrument cluster
- Ignition switch
- EPB module

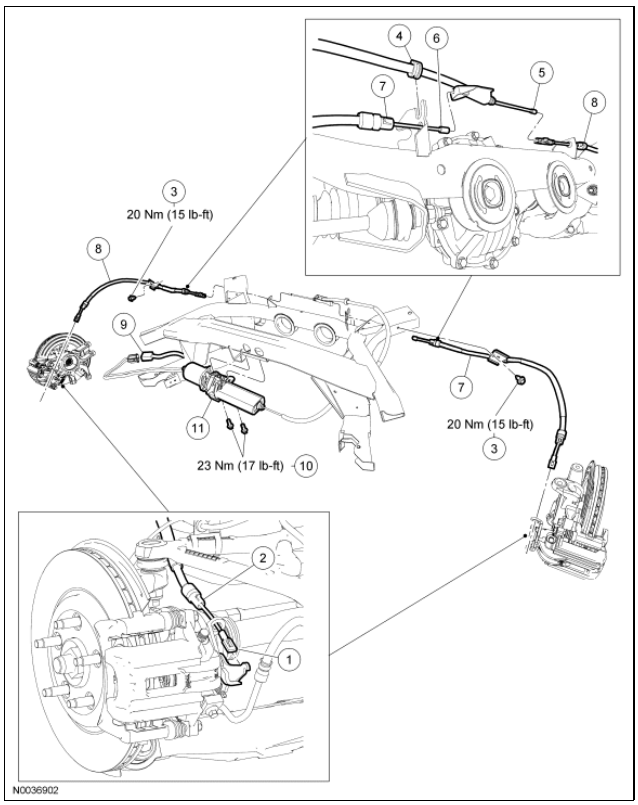
PINPOINT TEST L: DTCs U1027, U1040, U1051, U1058, AND U1134

Test Step	Result / Action to Take
L1 CHECK THE INTEGRITY OF THE SCP NETWORK	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test.	**Yes** GO to L2 . **No** REFER to Section 418-00 to continue diagnosis of the communications network.

• Carry out the network test. • **Do the ABS module, PCM and instrument cluster pass the network test?**	
L2 USE THE RECORDED DTCs FROM THE EPB MODULE CONTINUOUS AND ON-DEMAND SELF-TEST	
• Use the recorded results from the EPB module continuous and On-Demand Self-Test. • **Are any DTCs recorded?**	**Yes** For DTC U1027, GO to L3 . For DTC U1040, GO to L4 . For DTC U1051, GO to L5 . For DTC U1058, GO to L6 . For DTC U1134, GO to L7 . **No** Go to the Symptom Chart in this section.
L3 MONITOR THE ENGINE RPM	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: PCM PID. • Monitor the powertrain control module (PCM) engine RPM PID. • **Do the PID values agree with the engine RPM?**	**Yes** GO to L8 . **No** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis of the PCM.
L4 MONITOR THE WHEEL SPEED SENSOR PIDs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: ABS PID. • Monitor the wheel speed sensor PIDs while driving the vehicle at a constant speed. • **Are the wheel speed sensor PIDs consistent with the vehicle speed and each other?**	**Yes** GO to L8 . **No** REFER to Section 206-09 to continue diagnosis of the wheel speed sensor signals.
L5 MONITOR THE ABS MODULE STOPLAMP SWITCH	
• Ignition ON.	**Yes** GO to L8 .

• Enter the following diagnostic mode on the scan tool: ABS Module PID. • Monitor the brake pedal position switch PID while applying and releasing the brake pedal. • **Do the PID values agree with the brake pedal position?**	**No** REFER to Section 417-01 to continue diagnosis of the stoplamps.
L6 MONITOR THE PRNDL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: PCM PID. • Monitor the PCM digital transmission range (TR) sensor PID while selecting different gear positions. • **Do the PID values agree with the PRNDL display?**	**Yes** GO to L8 . **No** REFER to Section 307-01 to continue diagnosis of the digital TR sensor.
L7 MONITOR THE IGNITION SWITCH PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Monitor the instrument cluster ignition switch PID while selecting different switch positions. • **Do the PID values agree with the switch position?**	**Yes** GO to L8 . **No** REFER to Section 211-05 to continue diagnosis of the ignition switch.
L8 CHECK FOR CORRECT EPB MODULE OPERATION	
• Disconnect: EPB Module Connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect the EPB module connectors and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new EPB module. REFER to Parking Brake Module in this section. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. RESET the EPB system. REFER to Electronic Parking Brake (EPB) Resetting in this section.

Parking Brake — Exploded View



Item	Part Number	Description
1	—	Parking brake cable end (part of 2A635/2A823)
2	—	Parking brake cable and conduit (part of 2A635/2A823)
3	W706703	Parking brake cable bracket bolts (2 required)
4	2598	Electronic parking brake actuator cable grommet (part of 2598)
5	2598	Electronic parking brake actuator cable end (part of 2598)
6	2A823	LH parking brake cable end
7	2A823	Parking brake cable and conduit (LH)
8	2A635	Parking brake cable and conduit (RH)
9	—	Electronic parking brake actuator assembly electrical connector
10	W708829-S429	Electronic parking brake actuator assembly bolts (2 required)
11	2598	Electronic parking brake actuator assembly

1. For additional information, refer to the procedures in this section.

Parking Brake Cable

Removal

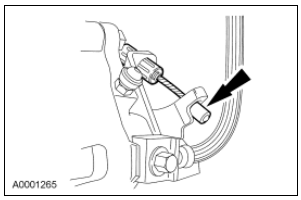
NOTE: LH shown, RH is similar.

1. Release the tension on the parking brake cables by connecting the diagnostic tool to the vehicle and following the diagnostic tool instructions to slacken the electronic parking brake cables.

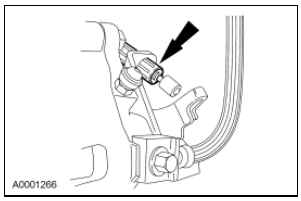
2. Separate the parking brake cable and conduit from the parking brake equalizer.

3. Release the parking brake cable and conduit from the subframe.

4. Release the parking brake cable end from the brake caliper parking brake lever.



5. Release and separate the parking brake cable and conduit from the brake caliper.

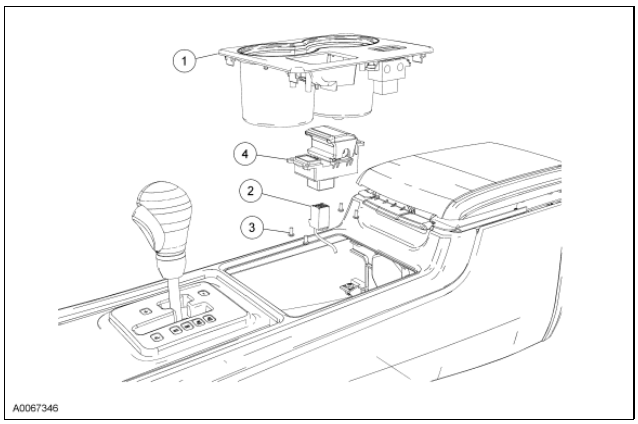


6. Remove the parking brake cable and conduit bracket bolt.
   - To install, tighten to 20 Nm (15 lb-ft).

7. Remove the parking brake cable and conduit from the vehicle.

8. To install, reverse the removal procedure.

Parking Brake Switch



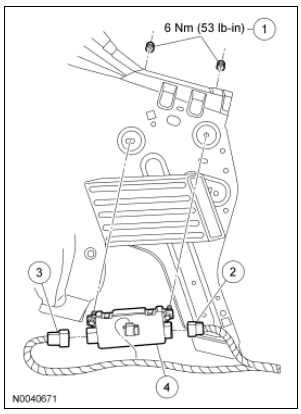
Item	Part Number	Description
1	13562	Floor console finish panel cup holder
2	—	Parking brake switch electrical connector
3	—	Parking brake switch screws (4 required)
4	2B623	Parking brake switch

Removal and Installation

NOTE: The electronic parking brake (EPB) system must be reset following the EPB system reset procedure if the battery has been disconnected. Refer to Electronic Parking Brake (EPB) Resetting in the diagnostic section.

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. Release the floor console finish panel cup holder from the floor console finish panel and position it aside.
3. Disconnect the parking brake switch electrical connector from the parking brake switch.
4. Remove the 4 parking brake switch screws.
5. Release the parking brake switch from the floor console finish panel cup holder.
6. To install, reverse the removal procedure.

Parking Brake Module



Item	Part Number	Description
1	W705790-S301	Electronic parking brake (EPB) module nuts (2 required)
2	—	EPB module electrical connector
3	—	EPB module electrical connector
4	2C496	EPB module

Removal

NOTE: If installing a new EPB module, the module must be configured. Follow the diagnostic tool instructions for configuring the EPB module. For additional information, refer to Section 418-01 .

1. Disconnect the battery. For additional information, refer to Section 414-01 .

2. Position the LH luggage compartment trim panel aside.

3. Disconnect the 2 EPB module electrical connectors.

4. Remove the 2 nuts and the EPB module.
   - To install, tighten to 6 Nm (53 lb-in).

5. To install, reverse the removal procedure.
   - If installing a new EPB module, configure the module. For configuration additional information, refer to Section 418-01 .

Parking Brake Actuator

Removal

NOTE: The electronic parking brake (EPB) system must be reset following the EPB system reset procedure if the battery has been discontinued. Refer to Electronic Parking Brake (EPB) Resetting in the diagnostic section.

1. Release the tension on the parking brake cables by connecting the diagnostic tool to the vehicle and following the diagnostic tool instructions to slacken the EPB cables.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Separate the EPB actuator cable from the parking brake cable and conduits at the equalizer.

4. Release the EPB actuator cable grommet from the subframe.

5. Disconnect the EPB actuator electrical connector.

6. Remove the 2 EPB actuator assembly bolts.
   - To install, tighten to 23 Nm (17 lb-ft).

7. To install, reverse the removal procedure.

General Specifications

Item	Specification
Lubricant	
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake line fitting	17	13	—
Brake booster nuts	27	20	—
Brake pedal bracket bolt	27	20	—
Brake fluid reservoir retaining screw	12	9	—
Brake master cylinder nuts	32	24	—
Power adjustable pedal motor screws	2	—	18

Hydraulic Brake Actuation

The brake system consists of:

- a vacuum-assisted power braking system.
- a power adjustable brake pedal with memory function, if equipped.
- a diagonal split hydraulic system.
- a 4-wheel anti-lock brake system (4WABS) available in 2 variants: 4WABS with Traction Control or 4WABS with Traction Control and Stability Assist (also referred to as Interactive Vehicle Dynamics [IVD] or Advance Trac). Refer to Section 206-09 .

Adjustable Pedals

The vehicle may be equipped with an adjustable brake and accelerator pedal system. Using the adjustable pedal switch, located on the instrument panel, the driver can adjust the brake and accelerator pedals for a more comfortable driving position.

Memory Adjustable Pedal Operation

The power adjustable pedals memory feature stores the current accelerator and brake pedal positions and recalls the previously stored pedal positions for a specified driver as directed by the memory feature. The adjustable pedals with memory:

- are operational with the ignition switch ON or OFF.
- can be adjusted forward or rearward using the adjustable pedal switch.
- retains 2 separate driver's pedal positions.
- updates the retained pedal position when that driver's memory is stored.
- moves the pedal to the retained pedal position when that driver's memory is recalled.
- stops pedal movement when any manual actuation of the pedal adjustment switch occurs while memory recall is moving the pedal.

Hydraulic Brake Actuation

Refer to Section 206-00 .

Adjustable Pedal Indexing

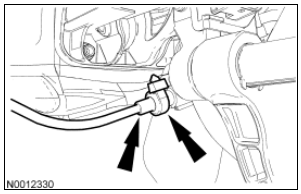
⚠ CAUTION: The adjustable pedal system must be indexed whenever the brake pedal assembly or accelerator pedal assembly is serviced.

1. Make sure the electrical connector is connected to the adjustable pedal motor.

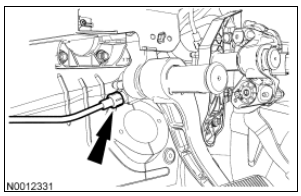
2. **NOTE:** A new adjustable brake pedal or adjustable accelerator pedal assembly will be in the full forward (towards the front of the vehicle) position.

   Operate the adjustable pedal to the full forward position. If the adjustable accelerator pedal bottoms before the adjustable brake pedal, operate both adjustable pedals full rearward.

3. Remove the tie-strap, if necessary, and disconnect the drive cable assembly from the adjustable brake pedal drive. Continue to operate the adjustable accelerator pedal to the full rearward position.

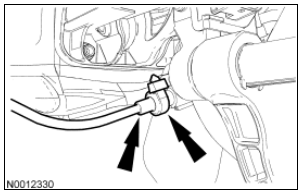


4. Connect the drive cable assembly to the adjustable brake pedal drive.

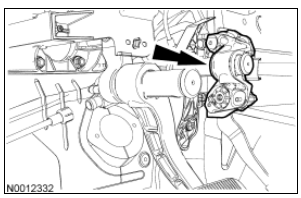


5. Operate both the adjustable pedals to the full forward position.

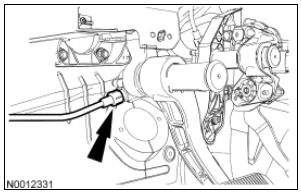
6. If the adjustable brake pedal bottoms before the adjustable accelerator pedal, remove the tie-strap, if necessary, and disconnect the adjustable brake pedal drive cable.



7. Operate the accelerator pedal to the full forward position.



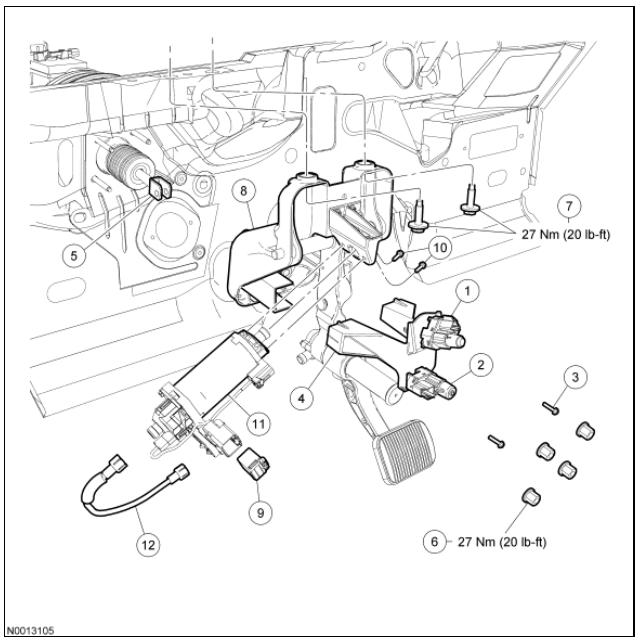
8. Connect the drive cable assembly to the adjustable brake pedal drive.



9. Operate both the adjustable pedals to the full forward position.

10. Check that the adjustable brake pedal and adjustable accelerator pedal can be adjusted fully forward, fully rearward, and they hit the forward and rearward stops at the same time.

Brake Pedal and Bracket



Item	Part Number	Description
1	13480	Stoplamp switch
2	9F924	Speed control deactivator switch electrical connector
3	—	Switch bracket screws (2 required)
4	2C433	Switch bracket
5	—	Brake booster rod
6	385759-S59	Brake booster nuts (4 required)
7	N806528-S58	Brake pedal bracket bolts (2 required)
8	2450	Brake pedal bracket (fixed/adjustable)
9	—	Adjustable brake pedal motor electrical connector
10	—	Adjustable brake pedal motor screws (2 required)
11	2C429	Adjustable brake pedal motor
12	2C431	Adjustable brake pedal drive cable

Removal and Installation

NOTE: The adjustable pedal assembly is shown; the fixed pedal assembly is similar.

1. Remove the steering column. For additional information, refer to Section 211-04 .
2. Remove the speed control deactivator switch. For additional information, refer to Section 310-03 .
3. Remove the stoplamp switch. For additional information, refer to Section 417-01 .
4. Remove the 2 switch bracket screws and position the switch bracket aside.
5. Remove the self-locking clip from the brake booster rod pin.

6. Remove the brake booster rod pin from the brake booster rod.

7. Position the brake pedal booster rod and bushing off the brake pedal.

8. If equipped with adjustable pedals, disconnect the adjustable pedal motor electrical connector.

9. Remove the 4 brake booster nuts.
    - To install, tighten to 27 Nm (20 lb-ft).

10. Remove the 2 upper brake pedal bracket bolts.
    - To install, tighten to 27 Nm (20 lb-ft).

11. Remove the brake pedal and bracket assembly from the vehicle.

12. To install, reverse the removal procedure.

Brake Pedal Motor

Removal and Installation

1. Remove the steering column. For additional information, refer to Section 211-04 .
2. Remove the 2 adjustable pedal motor screws and release the drive cable assemblies from the adjustable pedal motor.
3. Disconnect the adjustable pedal motor electrical connector.
4. Remove the adjustable pedal motor.
5. To install, reverse the removal procedure.

Brake Pedal Motor Cable

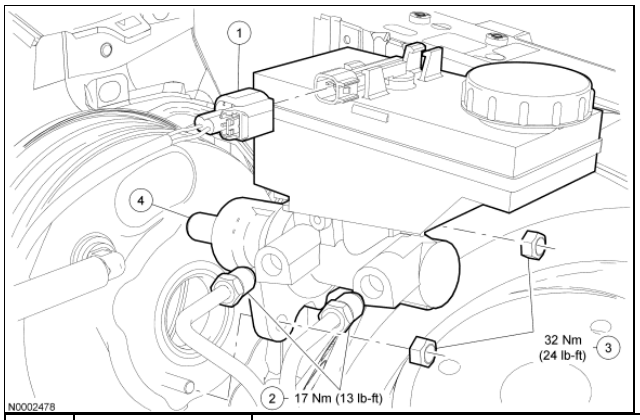
Removal and Installation

1. Remove the steering column. For additional information, refer to Section 211-04 .
2. Disconnect the drive cable assemblies from the brake pedal transmission.
3. Release the cable assembly from the adjustable pedal motor.
4. To install, reverse the removal procedure.

Brake Master Cylinder

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A



Item	Part Number	Description
1	—	Brake fluid level warning switch electrical connector (part of 14289)
2	2C326	Brake line fittings (2 required)
3	382802-S191	Master cylinder nuts (2 required)
4	2140	Brake master cylinder/reservoir assembly

Removal and Installation

⚠ WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. If equipped with interactive vehicle dynamics (IVD), disconnect the brake master cylinder pressure switch electrical connector.

2. Disconnect the brake fluid level switch electrical connector.

3. **NOTE:** Cap the brake line and plug the master cylinder ports after disconnecting the brake line fittings.

Disconnect the brake line fittings.

- To install, tighten to 17 Nm (13 lb-ft)

4. Remove the 2 brake master cylinder nuts.
   - To install, tighten to 32 Nm (24 lb-ft).

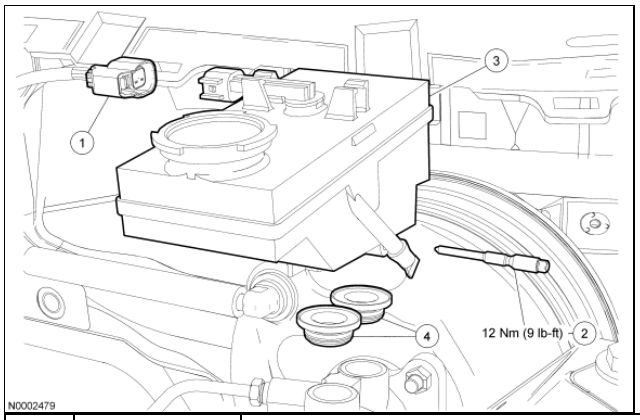
5. Remove the brake master cylinder.

6. To install, reverse the removal procedure.
   - Bleed the brake system. For additional information, refer to Section 206-00 .

Brake Fluid Reservoir

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A



Item	Part Number	Description
1	—	Brake fluid level warning switch electrical connector (part of 14289)
2	2462	Brake fluid reservoir retainer screw
3	2K478	Brake fluid reservoir
4	—	Brake fluid reservoir seals (2 required)

Removal and Installation

⚠ WARNING: Use of any other than approved DOT 3 motor vehicle brake fluid will cause permanent damage to brake components and will render the brakes inoperative. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Use a suitable suction device to drain the reservoir before removal.

2. Disconnect the brake fluid level switch electrical connector.

3. Remove the brake fluid reservoir retaining screw.
   - To install, tighten to 12 Nm (9 lb-ft).

4. Remove the brake fluid reservoir.

5. To install, reverse the removal procedure.

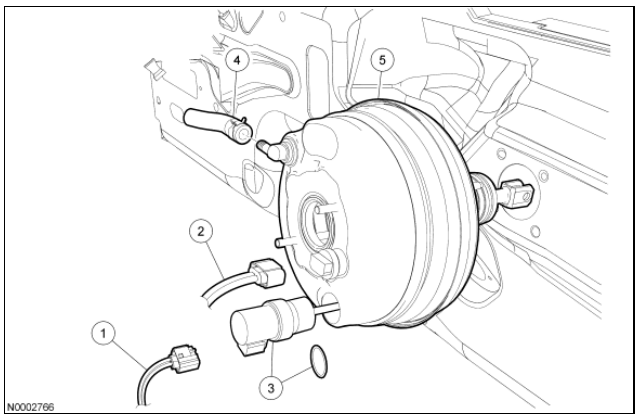
Torque Specifications

Description	Nm	lb-ft
Brake booster nut	27	20
Degas bottle bolt	15	11
Strut tower support brace bolt	20	15
Vapor management valve nut	28	21
Windshield wiper pivot arm nut	25	18

Power Brake System

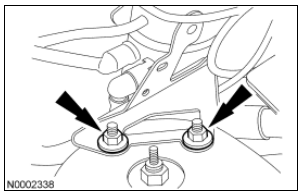
Refer to Section 206-00 .

Brake Booster

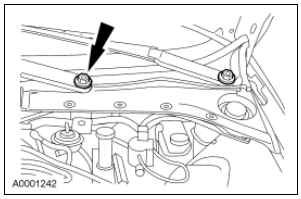


Item	Part Number	Description
1	—	Brake pedal travel switch (PTS) electrical connector (vehicles with Interactive Vehicle Dynamics [IVD])
2	—	Brake pedal force switch electrical connector (vehicles with IVD)
3	—	PTS and O-ring (vehicles with IVD)
4	2C429	Vacuum hose
5	2005	Brake booster assembly (vehicles with or without IVD)

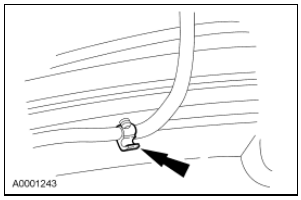
1. Remove the 2 nuts and position the vapor management valve (VMV) and bracket assembly aside.
    - To install, tighten to 28 Nm (21 lb-ft).



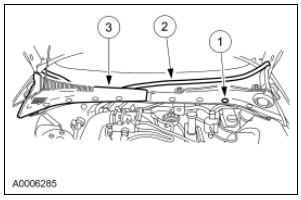
2. Remove the 2 nuts and the 2 windshield wiper pivot arms.
    - To install, tighten to 25 Nm (18 lb-ft).



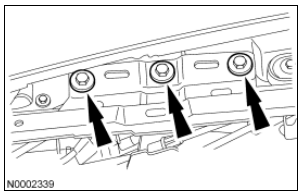
3. Disconnect the windshield washer hose.



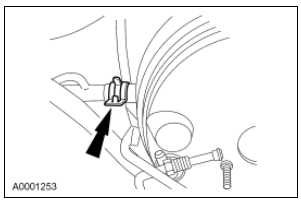
4. Remove the cowl panel grille.
    1. Remove the cowl panel grille pin-type retainers.
    2. Remove the cowl panel grille rubber trim.
    3. Remove the cowl panel grille.



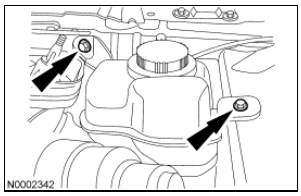
5. Remove the 7 bolts and the strut tower support brace.
    - To install, tighten to 20 Nm (15 lb-ft)



6. Disconnect the degas bottle return hose.



7. Remove the 2 degas bottle bolts and position the degas bottle aside.
    - To install, tighten to 15 Nm (11 lb-ft).



8. Remove the brake master cylinder. For additional information, refer to Section 206-06 .

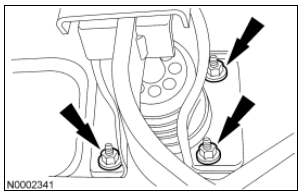
9. Disconnect the brake booster vacuum hose from the vacuum check valve.

10. Remove the speed control deactivation switch. For additional information, refer to Section 310-03 .

11. Remove the stoplamp switch. For additional information, refer to Section 417-01 .

12. Remove the 2 screws and the switch bracket.

13. Remove and discard the 4 brake booster-to-brake pedal bracket nuts.
    - To install, tighten to 27 Nm (20 lb-ft).



14. Disconnect the brake pedal pin from the brake booster input shaft.
    1. Remove the redundant self-locking clip.
    2. Disconnect the booster rod from the brake pedal.

15. Remove the brake booster from the vehicle.

16. To install, reverse the removal procedure.

General Specifications

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Anti-lock brake system (ABS) module-to-hydraulic control unit (HCU) bolts	2	—	18
Hydraulic control unit (HCU) bracket-to-HCU bolts	11	8	—
Brake line nut-to-hydraulic control unit (HCU) (M10)	18	13	—
Brake line nut-to-hydraulic control unit (HCU) (M12)	18	13	—
Hydraulic control unit (HCU) bracket-to-body bolts	18	13	—
Front wheel speed sensor bolt	3	—	27
Rear wheel speed sensor bolt	8	—	71
Yaw rate sensor nuts	7	—	62

Anti-Lock Control

Anti-Lock Brake System (ABS) with Traction Control

The anti-lock brake system (ABS) with Traction Control consists of the following components:

- Hydraulic control unit (HCU)
- ABS module
- Rear wheel speed sensors
- Rear wheel speed sensor ring (integral to the halfshaft)
- Front wheel speed sensors
- Front wheel speed sensor rings (integral to the hub and bearing assembly)
- Stability assist/traction control switch
- Yellow ABS warning indicator
- Stability assist/traction control active/fail warning lamp

The front wheel speed sensor rings are integral to the front hub and bearing assemblies. Refer to Section 204-01 .

The rear wheel speed sensor rings are integral to the rear halfshaft. Refer to Section 205-05 .

Anti-Lock Brake System (ABS) With Traction Control and Stability Assist

The anti-lock brake system (ABS) with Traction Control Stability Assist consists of these additional components:

- Yaw rate sensor (contains the accelerometer(s) and is also known as the Sensor cluster)
- Steering wheel rotation sensor
- Active brake booster
    - ♦ master cylinder pressure sensor
    - ♦ pedal travel sensor
    - ♦ brake pedal force switch

The front wheel speed sensor rings are integral to the front hub and bearing assemblies. Refer to Section 204-01 .

The rear wheel speed sensor rings are integral to the rear halfshaft. Refer to Section 205-05 .

Anti-Lock Control

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST1177-A	88 Digital Multimeter 105-R0053 or equivalent
ST2574-A	Flex Probe Kit 105-R025B
ST3030-A	Rotunda Active Wheel Speed Sensor Tester 105-R0110

Principles of Operation

Anti-Lock Brake System (ABS)

The anti-lock brake control module manages anti-lock braking, while the anti-lock brake control module with stability assist manages anti-lock braking, traction control and engine control systems to maintain vehicle control during deceleration and acceleration.

When the ignition switch is in the RUN position, the module will do a preliminary electrical check, and at approximately 20 km/h (12 mph), the hydraulic pump motor is turned on for approximately 1/2-second. Any malfunction of the anti-lock brake control system will disable the stability assist and the anti-lock brake warning indicator will illuminate. However, the power-assist braking system will function normally.

Electronic Brake Distribution (EBD)

The electronic brake distribution (EBD) controls rear brake pressure and acts as an electronic proportioning valve. It is controlled by the anti-lock brake system (ABS) module. When EBD is disabled, the amber ABS and the red brake warning indicators will illuminate.

Panic Assist Braking (ABS With Traction Control)

Panic assist braking functions by fully applying the brakes during a panic stop, using a specially developed pressure/pedal movement mechanism. Depending on vehicle speed, if pedal stroke is more rapid than normal,

the brake booster automatically applies full brake boost. Panic assist will be disabled when the driver releases the brake pedal.

Panic Assist Braking (ABS With Stability Control)

Panic assist braking functions by fully applying the brakes during a panic stop, using the active brake booster. The ABS module continuously monitors the pedal travel sensor and when a pedal stroke is more rapid than normal, the ABS module will energize the solenoid in the brake booster to apply full brake boost. Panic assist will be disabled when the driver releases the brake pedal.

Stability Assist

With the ignition in the START or RUN positions, the stability assist module functions similarly to a conventional anti-lock brake module by monitoring and comparing the rotational speed of each wheel. Wheel speeds are measured by the wheel speed sensor which electrically senses each tooth of the anti-lock sensor ring as they pass through the sensor's magnetic field. When the stability assist module detects an impending wheel lock, wheel spin or vehicle motion that is inconsistent with the driver commands, brake pressure is modulated to the appropriate brake caliper(s). The stability assist module triggers the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel(s) return to the desired speed, the stability assist module returns the solenoid valves to their normal position, and normal base brake operation is restored.

The ABS module communicates with the powertrain control module (PCM) to assist with traction control. At speeds under 100 km/h (62 mph), when the drive wheels lose traction and begin to spin, the stability assist module requests the PCM to reduce engine torque while simultaneously applying and releasing the appropriate brake caliper(s) to maintain traction. The PCM accomplishes this by minor incremental timing changes and fewer fuel injector pulses until the stability assist module ends the request. The request ends when the driven wheel speed returns to the desired speed. After the vehicle speed exceeds 100 km/h (62 mph), the traction control is accomplished only through the PCM torque control.

The stability assist system constantly monitors vehicle motion relative to the driver's intended course. This is done by using sensors to compare the driver's steering input and brake application with that of the actual vehicle motion. The system does not activate when the vehicle is traveling in reverse; however, ABS and traction control will continue to function as usual.

The stability assist control switch allows the driver to control use of the stability assist system. This is independent of the ABS function, which cannot be switched off by the driver. The stability assist system status is indicated by a stability assist warning lamp in the stability assist/traction control switch. An illuminated stability assist/traction control switch indicates that the stability assist system is switched off. In vehicles with a message center, the message AdvTrac OFF, T/C ON is displayed. The anti-lock brake function continues to work as designed unless the yellow anti-lock brake warning indicator is also illuminated. Normal braking function always occurs, unless the red brake warning indicator is illuminated.

When stability assist activates, any of the following can occur:

- A rumble or grinding sound much like ABS or traction control
- A small deceleration or a reduction in the acceleration of the vehicle
- The stability assist indicator will flash
- If the driver's foot is on the brake pedal, a vibration will be felt in the pedal much like ABS
- If the event is severe and the driver's foot is not on the brake, the brake pedal will move to apply higher brake forces. A whooshing sound can also be heard from under the instrument panel in an event this severe.

Some drivers may notice a slight movement of the brake pedal when the system checks itself. The brake pedal

moves when an active test of the brake booster is run. During this test a small amount of pressure will be generated at the master cylinder, but no pressure will be generated in the brake calipers.

Sensor Cluster (ABS With Stability Assist)

The sensor cluster (also called the yaw rate sensor) consists of the longitudinal and lateral accelerometer. The lateral accelerometer measures the acceleration which corresponds to the force involved when the vehicle slides sideways. This acceleration has 2 forms. The first is the centrifugal acceleration which is generated when the vehicle travels around in a circle. The second is the acceleration due to gravity. On level ground there is no contribution from this acceleration. However, if the vehicle is parked sideways on a bank or incline, the sensor will measure some lateral acceleration due to gravity even though the vehicle is not moving.

The yaw rate sensor measures the relative vehicle motion about the vertical axis through its center of gravity.

Steering Wheel Rotation Sensor (ABS With Stability Assist)

The steering wheel rotation sensor measures the rate of rotation of the steering wheel by monitoring the steering wheel rotation ring as it passes through the sensor gap. The steering wheel rotation sensor uses 2 signal lines to transmit information to the stability assist module, whether the steering wheel is being turned left or right and how far it is being turned. The steering wheel rotation sensor does not indicate the position of the steering wheel relative to straight-ahead. The stability assist system learns this position by comparing the steering wheel position with other signals and storing the position it has learned. The stability assist system confirms this position and modifies it as necessary during every new driving cycle.

Active Brake Booster (ABS With Stability Assist)

The active brake booster functions like a conventional brake booster with the added feature that it can be actuated electrically by the stability assist module. The electrical brake booster actuation is necessary during panic assist and severe stability assist events. During severe stability assist events, an electrical actuator of the booster ensures that the hydraulic control unit (HCU) can generate enough brake pressure to maintain vehicle stability. The brake assist from the brake booster is especially useful in cold weather when the hydraulic control unit cannot draw the brake fluid from the reservoir quickly at cold temperatures.

A solenoid within the active brake booster has a brake pedal force switch to indicate when the driver is stepping on the brake pedal. The solenoid provides electrical actuation of the brake booster. Without the force of the input rod, the air valve is directly opened due to the movement of the energized solenoid. With increasing current applied to the solenoid, the air valve opens and output force is created. With decreasing current applied to the solenoid, the air valve is closed and the vacuum valve opens, reducing output force. The brake pedal force switch indicates when the brake pedal has been applied. It is integrated into the booster key that normally sits against the rear shell of the boot in its rest position and it adjoins the valve body when in its balance position. The brake pedal force switch provides indication from 2 positions. In its rest position, it supplies 2 signals, normally open and normally closed. Upon application of sufficient force to initiate movement of the key away from the valve body, the brake pedal force switch changes state, signifying a driver application.

When the stability assist module is activating the brake booster, the brake pedal is pulled forward as the valve body moves. The brake pedal release switch is held in position by the input rod spring and remains against the valve body. Although the brake pedal position (BPP) switch changes state when the brake pedal drops, the brake pedal force switch remains inactive until it encounters an external force from the driver or a stability assist event controlled by the stability assist module.

Modules which are normally connected to the BPP switch are connected to a signal from the ABS module. This signal only changes state when the driver has applied the brake. If the ignition switch is in the RUN

position, the brake booster is not electrically actuated, and no failure has been detected, the driver brake application signal will indicate a brake applied when the brake pedal force switch built into the brake booster indicates that the driver has applied the brake pedal. If the ignition switch is in the OFF position, the driver brake application signal will indicate a brake apply only when the BPP switch indicates that the driver is applying the brake pedal. When the ignition switch is in the OFF position, failures cannot be detected. If there are failures, several layers of redundancy try to keep the driver brake application signal accurate. If the ABS module system detects faults on the driver brake application signal line it will also attempt to maintain correct stoplamp operation by communicating on the standard corporate protocol (SCP) network. Control of the stoplamp operation is also required because the BPP switch can change states during an ABS module event when the driver is not applying the brake pedal. The BPP switch can also change states during the system check of the brake booster. Only the ABS module system can interpret these changes and determine which ones are actually due to the driver applying the brake. Similarly, the ABS module system can take advantage of its other sensors to detect failures in the BPP switch.

ABS Module Configuration

The ABS module must be configured when a new ABS module is installed. If installing a new ABS module with stability assist, the calibration procedure as well as the configuration procedure must be carried out. Refer to Section 418-01 .

ABS Module Calibration (ABS With Stability Assist)

If a new ABS module is installed, it must be configured first. The ABS module also needs to be recalibrated whenever a component specific to the stability assist system is disconnected or a new component is installed. For additional information regarding the diagnostic trouble codes (DTCs) that require the recalibration procedure, refer to the ABS Calibration List. If a DTC is logged for any component of the stability assist system, the DTC must be cleared before carrying out the recalibration procedure. The need to recalibrate the ABS module is also indicated by the stability assist active/fail lamp flashing. The lamp will flash after clearing the DTCs that are indicated on the ABS Calibration List. If a DTC is retrieved after recalibration, refer to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Index. If installing a new stability assist module, the calibration procedures as well as the configuration procedure must be carried out. For additional information regarding the module configuration and calibration, follow the diagnostic tool directions for the calibration procedure.

When carrying out the sensor cluster calibration using the diagnostic tool, the vehicle must be on a level surface, must not be moving and the ignition switch must be in the RUN position. When carrying out the steering wheel rotation sensor calibration on the diagnostic tool, the ignition switch must be in the RUN position with the engine running and the steering wheel must be rotated back and forth from lock position to lock position.

Traction Control and Traction Control with Stability Assist

DTC C1963

This diagnostic trouble code (DTC) is stored if the traction control warning indicator has been turned ON because the system could not confirm the straight-ahead position for more than 30 seconds above 18 km/h (11 mph) or if the vehicle reaches 70 kph (43 mph) before confirming the straight-ahead position. This condition will most likely occur if there is some other DTC or if driving aggressively immediately after turning the ignition switch on. If there is another DTC logged, the repair procedure is to follow the procedure for the first DTC. This DTC can be stored if:

- the PRNDL or reverse switch has failed (check operation of PRNDL display and back-up lights).
- chassis modifications have been made that were not authorized by Ford.

In very rare circumstances this DTC can be stored by itself without the occurrence of any actual component failure. These conditions can cause DTC C1963 to set with no other DTC:

- The steering wheel has been turned while the ignition switch is in the OFF position and then the vehicle is started, and either the vehicle is driven continuously in a circle or the vehicle is driven with continuous swerving, sliding or tire spinning.
- A new traction control module has been installed in the vehicle and is not calibrated.

Inspection and Verification

NOTE: If a module is installed it must be reconfigured. Refer to Section 418-01 .

1. Verify the customer concern by operating the vehicle to duplicate the condition.

2. Verify the stoplamps operate correctly by applying and releasing the brake pedal with the ignition switch in the OFF position. If the stoplamps do not operate correctly, refer to Section 417-01 . If the stoplamps operate correctly, proceed to the next step.

3. Verify that the PRNDL operates correctly on the instrument cluster. If the PRNDL does not operate correctly, refer to Section 413-01 . If the PRNDL operates correctly, proceed to the next step.

4. Inspect to determine if any of the following mechanical or electrical concerns apply.

Visual Inspection Chart

Mechanical	Electrical
• Wheel speed sensor • Hydraulic control unit (HCU) • Incorrectly inflated tires • Mismatched wheels or tires on vehicle • Base brake concern • Brake booster vacuum hose • Ford-specified steering components, suspension components and tire size • Steering wheel rotation ring	• Auxiliary battery junction box (AJB) fuse(s): ♦ 14 (30A) ♦ 22 (40A) • ABS module • EVAC and fill connector • Wheel speed sensor • Advance Trac®/IVD switch • PTS switch • Steering wheel rotation sensor • Brake booster solenoid • Brake booster release switch • Brake pressure transducer • Yaw rate sensor (integral to sensor cluster) • Accelerometer (integral to sensor cluster) • Wiring harness • Connectors or connections • Circuitry

5. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connection of the data link connector to the vehicle.
    - check that the ignition switch is in the RUN position.

6. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.

7. Carry out the diagnostic tool data link test. If diagnostic tool responds with:
    - SCP or ISO; all electronic control units, no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for the ABS module, GO to Pinpoint Test A .
    - System passed, retrieve and record the continuous DTCs, clear the continuous DTCs, cycle the ignition switch OFF and ON, then carry out the self-test diagnostics for the ABS module.

8. If the DTCs retrieved are related to the concern, go to Anti-lock Brake System (ABS) (With or Without Advance Trac®/IVD) Module Diagnostic Trouble Code (DTC) Index to continue diagnosis.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnosis.

Anti-lock Brake System (ABS)/Traction Control and ABS/Traction Control with Advance Trac®/IVD Diagnostic Trouble Code (DTC) Index

NOTE: The need to recalibrate the module is indicated by the active/fail lamp flashing. There are other service actions that can require recalibration when there is no flashing lamp. The lamp will flash after clearing the DTCs that are indicated in the module calibration list.

NOTE: Always retrieve the continuous DTCs after running the self-test.

NOTE: For a complete master list of DTCs, refer to Section 419-10 .

Anti-lock Brake System (ABS)/Traction Control and ABS/Traction Control with Advance Trac®/IVD Diagnostic Trouble Code (DTC) Index

NOTE: DTC C1730 (Reference Voltage Out Of Range) must be repaired before DTC C1279, C1280, C1281, C1282, C1288, C1289.

DTC	Description	Source	Action
B1342 [a]	ECU Is Defective	ABS [a]	**NOTE:** If other DTCs are present, REPAIR them before installing a new component. CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is still present, INSTALL a new module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test.
B1483 [a]	Brake Pedal Input Circuit Failure	ABS [a]	GO to Pinpoint Test B .
B1676 [a]	Battery Pack Voltage Out of Range	ABS [a]	GO to Pinpoint Test C .

B2477 [a]	Module Configuration Failure	ABS [a]	Follow the diagnostic tool directions for the calibration procedure.
B2734 [b]	Pedal Travel Sensor (PTS) Supply Error	ABS [b]	Follow the diagnostic tool directions for the calibration procedure.
B2736 [b]	Pedal Travel Sensor (PTS) Circuit Fault	ABS [b]	Follow the diagnostic tool directions for the calibration procedure.
B2737 [b]	Pedal Travel Sensor (PTS) Jammed Error	ABS [b]	Follow the diagnostic tool directions for the calibration procedure.
B2738 [b]	Pedal Travel Sensor (PTS) Velocity Error	ABS [b]	Follow the diagnostic tool directions for the calibration procedure.
B2740 [b]	Pedal Travel Sensor (PTS) Spike Error	ABS [b]	Follow the diagnostic tool directions for the calibration procedure.
B2741 [b]	Sensor Cluster Loop End	ABS [b]	Follow the diagnostic tool directions for the calibration procedure.
B2900 [a]	VIN Mismatched	ABS [a]	VERIFY that the ABS module has the correct as-built data.
C1095 [a]	ABS Hydraulic Pump Motor Circuit Failure	ABS [a]	GO to Pinpoint Test D .
C1145 [a]	Wheel Speed Sensor RF Input Circuit Failure	ABS [a]	GO to Pinpoint Test E .
C1155 [a]	Wheel Speed Sensor LF Input Circuit Failure	ABS [a]	GO to Pinpoint Test E .
C1165 [a]	Wheel Speed Sensor RR Input Circuit Failure	ABS [a]	GO to Pinpoint Test E .
C1175 [a]	Wheel Speed Sensor LR Input Circuit Failure	ABS [a]	GO to Pinpoint Test E .
C1233 [a]	Wheel Speed LF Input Signal Missing	ABS [a]	GO to Pinpoint Test F .
C1234 [a]	Wheel Speed RF Input Signal Missing	ABS [a]	GO to Pinpoint Test F .
C1235 [a]	Wheel Speed RR Input Signal Missing	ABS [a]	GO to Pinpoint Test F .
C1236 [a]	Wheel Speed LR Input Signal Missing	ABS [a]	GO to Pinpoint Test F .
C1277 [a]	Steering Wheel Angle 1 and 2 Circuit Failure	ABS [a]	GO to Pinpoint Test G .
C1278 [b]	Steering Wheel Angle 1 and 2 Signal Faulted	ABS [b]	GO to Pinpoint Test G .
C1279 [b]	Yaw Rate Sensor Circuit Failure	ABS [b]	GO to Pinpoint Test H .
C1280 [b]	Yaw Rate Sensor Signal Fault	ABS [b]	GO to Pinpoint Test H .
C1281 [b]	Lateral Accelerometer Circuit Failure	ABS [b]	GO to Pinpoint Test H .
C1282 [b]	Lateral Accelerometer Signal Fault	ABS [b]	GO to Pinpoint Test H .
C1285 [b]	Booster Solenoid Circuit Failure	ABS [b]	GO to Pinpoint Test I .

C1287 [b]	Booster Pedal Force Switch Circuit Failure	ABS [b]	GO to Pinpoint Test J .
C1288 [b]	Brake Pressure Transducer Input Circuit Failure	ABS [b]	GO to Pinpoint Test K .
C1440	Pressure Transducer Input Circuit Failure	ABS [b]	GO to Pinpoint Test P .
C1730 [b]	Reference Voltage Out of Range (+5 V)	ABS [b]	GO to Pinpoint Test L .
C1805 [b]	Mismatched PCM and/or ABS Module	ABS [b]	CHECK for correct component and correct PCM and ABS module configuration. INSTALL a new component as necessary. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test.
C1963 [b]	Stability Control Inhibit Warning	ABS [b]	This DTC is for information only. GO to the Principles of Operation. CLEAR the DTC. REPEAT the self-test.
C1969 [b]	Traction Control/Yaw Control Switch Lamp Circuit Fault	ABS	GO to Pinpoint Test Q .
C1991 [b]	Module Calibration Failure	ABS	CALIBRATE the Traction Control Module. REFER to Section 418-00 .
C1996 [b]	Active Yaw Control Disabled	ABS	This DTC can be set if the Advance Trac®/IVD System is activated for 15 seconds of continuous operation. CHECK for any major chassis modifications, gross suspension misalignment or other items that can alter the vehicle tracking dynamics.
C1998 [b]	Module Calibration Not Complete	ABS	GO to Pinpoint Test R .
C2769	Longitudinal Acceleration Sensor Circuit Failure	ABS	GO to Pinpoint Test H .
C2770	Longitudinal Acceleration Sensor Signal Fault	ABS	GO to Pinpoint Test H .
C2777 [b]	Sensor Cluster Bus Failure	ABS	GO to Pinpoint Test S .
C2788 [b]	Sensor Power Supply Failure	ABS	GO to Pinpoint Test S .
U1009	SCP (J1850) Invalid or Missing Data for Engine Torque	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1262	SCP (J1850) Communication Bus Fault	Network Fault	REFER to Section 418-00 .
U1900	CAN Network 1 Communication Bus Fault-Receive Error	Network Fault	REFER to Section 418-00 .
U1901	CAN Network 2 Communication Bus	Network	REFER to Section 418-00 .

	Fault-Receive Error	Fault	

[a] ABS/Traction Control and Advance Trac®/IVD
[b] ABS with Advance Trac

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
P2106	Throttle Actuator Control System â— â— Forced Limit Power	PCM	Repair all other ABS module DTCs first. If the DTC is still present, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Calibration List

NOTE: The need to recalibrate the ABS module is indicated by the Advance Trac®/IVD active/fail lamp flashing. The lamp will flash after the DTCs on the calibration list are cleared.

Calibration List

DTC	Description	Calibration
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	YES
C1278	Steering Wheel Angle 1 and 2 Signal Fault	YES
C1279	Yaw Rate Sensor Circuit Failure	YES
C1280	Yaw Rate Sensor Signal Fault	YES
C1281	Lateral Accelerometer Circuit Failure	YES
C1282	Lateral Accelerometer Signal Fault	YES
C1283	Switch Test Signal Fault	YES
C1285	Booster Solenoid Circuit Failure	YES
C1286	Booster Mechanical Failure	YES
C1287	Booster Pedal Force Switch Circuit Failure	YES
C1288	Brake Pressure Transducer Input Circuit Failure	YES
C1730	Reference Voltage Out of Range (+5 V)	YES
C1960	Driver Brake Apply Circuit Failure	NO
C1963	Stability Control Inhibit Warning	NO
C2769	Longitudinal Acceleration Sensor Circuit Failure	YES
C2770	Longitudinal Acceleration Sensor Signal Fault	YES

Symptom Chart

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Symptom Chart

Pinpoint Tests

Pinpoint Test A: No Communication With The Anti-lock Brake System (ABS) Module

Normal Operation

The operating voltage required to supply the ABS module, hydraulic pump, and isolation valves is in a range between 10 and 17 volts.

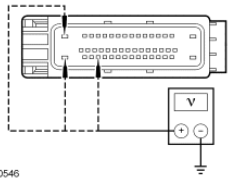
Voltage is supplied by circuit 30-CF6B (RD), circuit 30-CF13 (RD) (power hot at all times) and circuit 20-CF6A (PK/YE) (hot in RUN). Ground is provided through circuit 31-CF6C (BK/YE) and 31-CF6D (BK).

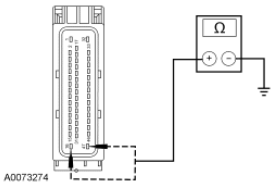
Possible Causes

- Charging system
- Battery
- Ground circuit 31-CF6C (BK/YE) or 31-CF6D (BK)
- Power supply:
  - ♦ circuit 30-CF13 (RD) open
  - ♦ circuit 30-CF6B (RD) open
  - ♦ circuit 20-CF6A (PK/YE) open
  - ♦ fuse

PINPOINT TEST A: NO COMMUNICATION WITH THE ABS MODULE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
A1 CHECK THE VOLTAGE TO THE ABS MODULE	
• Ignition OFF. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between ABS module C155-1, circuit 30-CF13 (RD), harness side and ground; and between ABS module C155-32, circuit 30-CF6B (RD), harness side and ground; and between ABC module C155-4, circuit 20-CF6A (PK/YE), harness side and ground; and between ABS module C155-4, circuit 20-CF6A (PK/YE), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY power distribution box (PDB) fuse 3 (5A) is OK. If OK, REPAIR the circuit in question. REPEAT the self-test.
A2 CHECK THE ABS MODULE GROUNDS	

• Ignition OFF. • Measure the resistance between ABS module C155-16, circuit 31-CF6C (BK/YE), harness side and ground; and between ABS module C155-47 circuit 31-CF6D (BK) harness side and ground.  • **Are the resistances less than 5 ohms?**	**Yes** CHECK the module communications network. REFER to Section 418-00 . **No** REPAIR the circuit in question. REPEAT the self-test.

Pinpoint Test B: DTC B1483 — Brake Pedal Input Circuit Failure

Normal Operation

The operating voltage required to supply the pedal travel switch (PTS) switch is 5 volts through circuit 7-CF65 (YE/VT).

The PTS signal is sent through circuit 8-CF65 (WH/VT) to the ABS module.

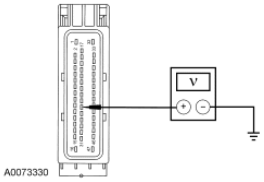
Ground is provided through circuit 9-CF65 (BN/WH).

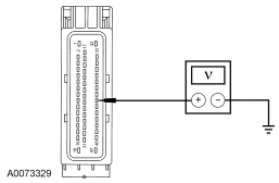
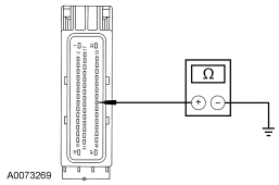
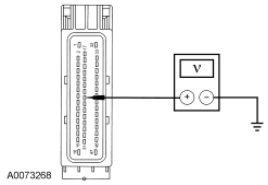
Possible Causes

- Power circuit 7-CF65 (YE/VT) open
- Ground circuit 9-CF65 (BN/WH) short to voltage
- Signal circuit 8-CF65 (WH/VT) open or short to voltage

PINPOINT TEST B: DTC B1483 — BRAKE PEDAL INPUT CIRCUIT FAILURE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
B1 CHECK CIRCUIT 7-CF65 (YE/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: ABS Module C155. • Measure the voltage between ABS module C155-26, circuit 7-CF65 (YE/VT), harness side and ground.  	**Yes** GO to B2 . **No** REPAIR the circuit in question 7-CF65 (YE/VT). CLEAR the DTC. REPEAT the self-test.

• **Is the voltage greater than 10 volts?**	
B2 CHECK CIRCUIT 8-CF65 (WH/VT)	
• Measure the voltage between ABS module C155-40, circuit 8-CF65 (WH/VT), harness side and ground, while applying and releasing the brake pedal.  • **Is the voltage greater than 10 volts with the brake pedal applied, and 0 volts with the brake pedal released?**	**Yes** INSTALL a new pedal travel switch (PTS). REFER to Section 417-01 . CLEAR the DTC. REPEAT the self-test. **No** GO to B3 .
B3 CHECK CIRCUIT 8-CF65 (WH/VT) FOR A SHORT TO GROUND	
• Measure the resistance between ABS module C155-40, circuit 8-CF65 (WH/VT), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B4 . **No** REPAIR the circuit in question 8-CF65 (WH/VT). CLEAR the DTC. REPEAT the self-test.
B4 CHECK CIRCUIT 9-CF65 (BN/WH) FOR A SHORT TO VOLTAGE	
• Measure the voltage between ABS module C155-24, circuit 9-CF65 (BN/WH), harness side and ground.  • **Is voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTC. REPEAT the self-test. **No** INSTALL a new pedal travel switch (PTS) switch. REFER to Section 417-01 . CLEAR the DTC. REPEAT the self-test.

Pinpoint Test C: DTC B1676 — Battery Pack Voltage Out Of Range

Normal Operation

The vehicle electrical system supplies 12 volts to the anti-lock brake system (ABS) module.

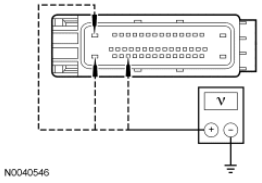
Voltage is supplied by circuit 30-CF6B (RD) and circuit 30-CF13 (RD) (power hot at all times). Ground is provided through circuit 31-CF6C (BK/YE) and 31-CF6D (BK).

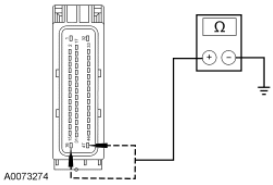
Possible Causes

- Charging system
- Battery
- Ground circuit 31-CF6C (BK/YE) or 31-CF6D (BK)
- Power supply:
  - ♦ circuit 30-CF13 (RD) open
  - ♦ circuit 30-CF6B (RD) open

PINPOINT TEST C: DTC B1676 — BATTERY PACK VOLTAGE OUT OF RANGE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
C1 CHECK THE BATTERY VOLTAGE	
• Measure the battery voltage between the positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running. • **Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running?**	**Yes** GO to C2 . **No** CHECK the charging system. REFER to Section 414-00 . TEST the system for normal operation.
C2 CHECK VOLTAGE TO THE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE	
• Ignition OFF. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between ABS module C155-1, circuit 30-CF13 (RD), harness side and ground; and between ABS module C155-32, circuit 30-CF6B (RD), harness side and ground and between ABS module C155-4, circuit 20-CF6B (PK/YE), harness side and ground.  N0040546 • **Are the voltages greater than 10 volts?**	**Yes** GO to C3 . **No** REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.
C3 CHECK THE ABS MODULE GROUNDS	

• Ignition OFF. • Measure the resistance between ABS module C155-16, circuit 31-CF6C (BK/YE), harness side and ground; and between ABS module C155-47 circuit 31-CF6D (BK) harness side and ground.  • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.

Pinpoint Test D: DTC C1095 — Anti-lock Brake system (ABS) Hydraulic Pump Motor Circuit Failure

Normal Operation

The operating voltage required to run the hydraulic pump motor is in a range between 10 and 17 volts.

Voltage is supplied by circuit 30-CF13 (RD) (power hot at all times). Ground is provided through circuit 31-CF6C (BK/YE) and 31-CF6D (BK/YE).

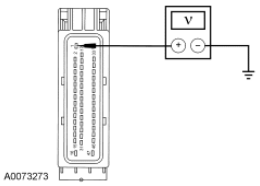
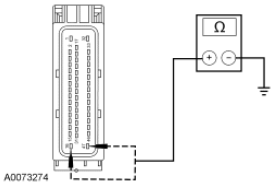
Possible Causes

- Ground circuit 31-CF6C (BK/YE) or 31-CF6D (BK) open
- Power supply circuit 30-CF13 (RD) open
- Hydraulic pump motor
- ABS module

PINPOINT TEST D: DTC C1095 — ABS HYDRAULIC PUMP MOTOR CIRCUIT FAILURE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
D1 CHECK THE ABS PUMP MOTOR	
• Ignition ON. • **Is the ABS pump motor running all the time?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test. **No** GO to D2 .
D2 CHECK THE PUMP MOTOR OPERATION	
• Ignition ON. • Trigger the ABS module pump motor ON active command.	**Yes** CLEAR the DTC. CHECK the yellow ABS warning indicator while driving the vehicle (brakes must not be applied) above 32 km/h (20 mph). If the

• **Does the ABS pump motor run for approximately 3 seconds?**	yellow ABS warning indicator illuminates, RETRIEVE the DTCs. If DTC C1095 is retrieved, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test. If the yellow ABS warning indicator does not illuminate, the system is OK. **No** TRIGGER the ABS module pump motor OFF active command. GO to D3 .
D3 CHECK CIRCUIT 30-CF13 (RD) FOR AN OPEN	
• Disconnect: ABS Module C155. • Measure the voltage between ABS module C155-1, circuit 30-CF13 (RD) harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to D4 . **No** REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.
D4 CHECK CIRCUIT 31-CF6C (BK/YE) OR 31-CF6D (BK) FOR AN OPEN	
• Measure the resistance between ABS module C135-16, circuit 31-CF6C (BK/YE) harness side and ground; and between ABS module C135-47, circuit 31-CF6D (BK) harness side and ground. Then, measure the resistance between ABS module C135-16 circuit 31-CF6C (BK/YE) and C135-47 circuit 31-CF6D (BK), component side.  • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new hydraulic control unit (HCU). REFER to Hydraulic Control Unit (HCU) in this section. CLEAR the DTC. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.

Pinpoint Test E: DTC C1145 (RF), DTC C1155 (LF), DTC C1165 (RR), DTC C1175 (LR) — Wheel Speed Sensor Input Circuit Failure

Normal Operation

The active wheel speed sensor generates a square wave signal that is sent to the anti-lock brake system (ABS) module. The wheel speed sensor circuitry connects to the ABS module connector C155 through 2 wires and a connector at each wheel speed sensor. When the ignition is turned to the RUN position, the ABS module carries out a self-test by sending a reference voltage through the right front wheel speed sensor and its circuitry to determine if they are functional.

12 volts are supplied to the active wheel speed sensors from the ABS module. The wheel speed sensor ground is supplied by the ABS module.

Possible Causes

- Wheel speed sensor
- Wheel speed sensor harness circuit (power or ground)
- ABS or wheel speed sensor connector(s)

PINPOINT TEST E: DTC C1145 (RF), DTC C1155 (LF), DTC C1165 (RR), DTC C1175 (LR) — WHEEL SPEED SENSOR INPUT CIRCUIT FAILURE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
E1 CHECK FOR FAULT REPEATABILITY	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear the Continuous DTCs. • Drive the vehicle at least 16 km/h (10 mph). • Retrieve and document continuous DTCs. • **Is DTC C1145, C1155, C1165 or C1175 retrieved?**	**Yes** If the active wheel speed sensor tool is not available, GO to E4 . If the active wheel speed sensor tool is available, GO to E2 . **No** INSPECT the wheel speed sensors, wheel speed sensor wiring and wheel speed sensor tone rings. REPAIR or INSTALL new as necessary. If any other DTCs are retrieved, GO to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Index.
E2 CHECK THE ABS MODULE OUTPUT USING THE SPECIAL TOOL	
• Ignition OFF. • Disconnect: Suspect Wheel Speed Sensor. • Connect the special tool to the wheel speed sensor connectors. • Ignition ON. • Select the correct system polarity on the special tool and turn the special tool power switch to the ON position. • **Is the module output LED illuminated?**	**Yes** GO to E3 . **No** GO to E6 .

<table>
<tr><td>E3 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE SPECIAL TOOL</td><td></td></tr>
<tr><td>• Raise the suspect wheel until it can spin freely. Refer to Section 100-02 .
• While monitoring the special tool, slowly spin the suspect wheel.
• Do the sensor output LEDs illuminate and flash and is the current overload LED not illuminated?</td><td>Yes
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

No
If the current level LED is not illuminated and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test.

If the current level LED is not illuminated and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. If the tone ring is OK, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>E4 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>NOTE: Both circuits must be checked for each DTC.

• Ignition OFF.
• Disconnect: ABS Module C155.
• Disconnect: Suspect Wheel Speed Sensor.
• Ignition ON.
• Measure the voltage between ABS module C155 pins, harness side and ground, as follows:

<table><tr><th>DTC</th><th>ABS Module C155 Pin</th><th>Circuit</th></tr><tr><td>C1145 (RF)</td><td>33</td><td>8-CF38 (WH/RD)</td></tr><tr><td>C1145 (RF)</td><td>34</td><td>7-CF38 (YE/RD)</td></tr><tr><td></td><td>45</td><td>7-CF32 (YE)</td></tr></table></td><td>Yes
REPAIR the circuit in question. CLEAR the DTC(s). REPEAT the self-test.

No
GO to E5 .</td></tr>
</table>

C1155 (LF)		
C1155 (LF)	46	8-CF32 (WH)
C1165 (RR)	42	8-CF40 (WH/GN)
C1165 (RR)	43	7-CF40 (YE/GN)
C1175 (LR)	36	7-CF34 (YE/BU)
C1175 (LR)	37	8-CF34 (WH/BU)

- **Is voltage present?**

E5 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO GROUND

NOTE: Both circuits must be checked for each DTC.

- Ignition OFF.
- Measure the resistance between ABS module C155 pins harness side and ground, as follows:

DTC	ABS Module C155 Pin	Circuit
C1145 (RF)	33	8-CF38 (WH/RD)
C1145 (RF)	34	7-CF38 (YE/RD)
C1155 (LF)	45	7-CF32 (YE)
C1155 (LF)	46	8-CF32 (WH)
C1165 (RR)	42	8-CF40 (WH/GN)
C1165 (RR)	43	7-CF40 (YE/GN)
C1175 (LR)	36	7-CF34 (YE/BU)
C1175 (LR)	37	8-CF34 (WH/BU)

- **Are the resistances greater than 10,000 ohms?**

Yes
GO to E6 .

No
REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.

E6 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

- Ignition OFF.
- Disconnect: ABS Module C155.
- Disconnect: Suspect Wheel Speed Sensor.
- Measure the resistance between ABS module C155 pins, harness side and the suspect wheel speed sensor connector pins, harness side as follows:

DTC	Circuit	ABS Module C155 Pin	Wheel Speed Sensor Connector Pin
C1145 (RF)	8-CF38 (WH/RD)	33	2
C1145 (RF)	7-CF38 (YE/RD)	34	1
C1155 (LF)	7-CF32 (YE)	45	1
C1155 (LF)	8-CF32 (WH)	46	2
C1165 (RR)	7-CF40 (YE/GN)	43	2
C1165 (RR)	8-CF40 (WH/GN)	42	1
C1175 (LR)	8-CF34 (WH/BU)	37	1
C1175 (LR)	7-CF34 (YE/BU)	36	2

- **Are the resistances less than 5 ohms?**

Yes
GO to E7 .

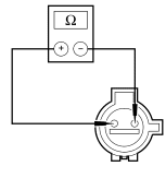
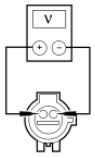
No
REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.

E7 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT

- Measure the resistance between the suspect wheel speed sensor pins.

Yes
GO to E8 .

No
REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.

 A0057968 • **Is the resistance greater 10,000 ohms?**	
E8 CHECK THE ABS MODULE OUTPUT	
• Connect: ABS Module C155. • Ignition ON. • Measure the voltage between the suspect wheel speed sensor pins, harness side.  A0057374 • **Is the voltage less than 9 volts?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test. **No** INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. CLEAR the DTC. REPEAT the self-test. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTC. REPEAT the self-test.

Pinpoint Test F: DTC C1233 (LF), DTC C1234 (RF), DTC C1235 (RR), DTC C1236 (LR) — Wheel Speed Sensor Input Signal Missing

Normal Operation

The wheel speed sensor and sensor ring generate a square wave signal to the anti-lock brake system (ABS) module that is proportional to wheel speed. The ABS module compares wheel speed inputs from all wheel speed sensors to determine an impending wheel lockup.

Possible Causes
- Mismatched tire sizes
- Wheel speed sensor ring
- Wheel speed sensor
- ABS module

PINPOINT TEST F: DTC C1233 (LF), DTC C1234 (RF), DTC C1235 (RR), DTC C1236 (LR) — WHEEL SPEED SENSOR INPUT SIGNAL MISSING

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
F1 CHECK FOR DTCs	
• Ignition ON.	**Yes** GO to Pinpoint Test E .

<table>
<tr><td>• Connect the scan tool.
• Is DTC C1145, C1155, C1165 or C1175 present?</td><td>No
GO to F2 .</td></tr>
<tr><td>F2 CHECK THE WHEEL SPEED PIDs</td><td></td></tr>
<tr><td>• Use the diagnostic tool to monitor the wheel speed PIDs while driving the vehicle at a constant speed.
• Are the 4 wheel speed PID values similar?</td><td>Yes
CLEAR the DTC. DRIVE the vehicle. RETRIEVE DTCs. If DTC C1233, C1234, C1235 or C1236 is present, INSTALL a new anti-lock brake control module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test.

No
If the active wheel speed sensor tool is available, GO to F3 . If the active wheel speed sensor tool is not available, GO to F6 .</td></tr>
<tr><td>F3 CHECK THE ABS MODULE OUTPUT USING THE SPECIAL TOOL</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: Suspect Wheel Speed Sensor.
• Connect the special tool to the wheel speed sensor connectors.
• Ignition ON.
• Select the correct system polarity on the special tool and turn the special tool power switch to the ON position.
• Is the module output LED illuminated?</td><td>Yes
GO to F5 .

No
GO to F4 .</td></tr>
<tr><td>F4 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN</td><td></td></tr>
<tr><td>NOTE: Both circuits must be checked for each DTC.

• Ignition OFF.
• Disconnect: ABS Module C155.
• Measure the resistance between ABS module C155, harness side and suspected wheel speed sensor connector, harness side, as follows:

<table>
<tr><th>DTC</th><th>Circuit</th><th>ABS Module Connector-Pin</th><th>Wheel Speed Sensor Connector-Pin</th></tr>
<tr><td>C1233</td><td>7-CF32 (YE)</td><td>C155-45</td><td>LH front wheel speed sensor C150-1</td></tr>
<tr><td>C1233</td><td></td><td>C155-46</td><td></td></tr>
</table>
</td><td>Yes
GO to F7 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</td></tr>
</table>

	8-CF32 (WH)		LH front wheel speed sensor C150-2
C1234	8-CF38 (WH/RD)	C155-33	RH front wheel speed sensor C160-2
C1234	7-CF38 (YE/RD)	C155-34	RH front wheel speed sensor C160-1
C1235	7-CF40 (YE/GN)	C155-43	RH rear wheel speed sensor C426-2
C1235	8-CF40 (WH/GN)	C155-42	RH rear wheel speed sensor C426-1
C1236	8-CF34 (WH/BU)	C155-37	LH rear wheel speed sensor C440-1
C1236	7-CF34 (YE/BU)	C155-36	LH rear wheel speed sensor C440-2

- **Are the resistances less than 5 ohms?**

F5 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE SPECIAL TOOL	
• Raise the suspect wheel until it can spin freely. Refer to Section 100-02 . • While monitoring the special tool, slowly spin the suspect wheel. • **Do the sensor output LEDs illuminate and flash and is the current overload LED not illuminated?**	**Yes** INSPECT the wheel speed sensor tone ring for damage and looseness. INSTALL new components as necessary. If the tone ring is OK, the concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. **No** If the current level LED is not illuminated and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test. If the current level LED is not illuminated and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. If the tone ring is OK, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel

	Speed Sensor — Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test.
F6 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE OUTPUT	
• Ignition OFF. • Disconnect: Suspect Wheel Speed Sensor. • Ignition ON. • Measure the voltage between ABS module C155 pins, harness side and ground, as follows: **DTC / Circuit / Wheel Speed Sensor Connector** C1234 (RF) / 8-CF38 (WH/RD) / 2 C1234 (RF) / 7-CF38 (YE/RD) / 1 C1233 (LF) / 7-CF32 (YE) / 1 C1233 (LF) / 8-CF32 (WH) / 2 C1235 (RR) / 7-CF40 (YE/GN) / 1 C1235 (RR) / 8-CF40 (WH/GN) / 2 C1236 (LR) / 8-CF34 (WH/BU) / 1 C1236 (LR) / 7-CF34 (YE/BU) / 2 • **Are the voltages greater than 9 volts?**	**Yes** INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. CLEAR the DTC. REPEAT the self-test. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTC. REPEAT the self-test. **No** GO to F7 .
F7 CHECK THE WHEEL SPEED SENSOR FOR DAMAGE AND/OR LOOSENESS	
• Ignition OFF. • With the vehicle in NEUTRAL, position the vehicle on a hoist. Refer to Section 100-02 . • ***NOTICE:*** **Examine the wheel speed sensor wire carefully with a good light. Failure to verify damage in the wheel speed sensor wire can lead to unnecessary installation of a new component.** • Inspect the wheel speed sensor mounting for looseness. If the wheel speed sensor is suspected, inspect the sensor for corrosion or on the front anti-lock brake mounting flange. Clean as necessary.	**Yes** GO to F8 . **No** INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. CLEAR the DTC. REPEAT the self-test. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTC. REPEAT the self-test.

• **Is the wheel speed sensor OK?**	
F8 CHECK FOR WHEEL SPEED SENSOR RING DAMAGE	
• Remove the wheel speed sensor. • Inspect the wheel speed sensor ring for damaged or missing teeth. Rotate the wheel to verify that no teeth are missing. • **Is the wheel speed sensor ring OK?**	**Yes** INSTALL a new anti-lock brake control module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** INSTALL a new wheel speed sensor ring. For the front wheel speed sensor ring, REFER to Section 204-01 . CLEAR the DTC. REPEAT the self-test. For the rear wheel speed sensor ring, REFER to Section 205-05 . CLEAR the DTC. REPEAT the self-test.

Pinpoint Test G: DTC C1277/C1278 — Steering Wheel Angle 1 and 2 Circuit Failure/Faulted

Normal Operation

The steering wheel rotation sensor monitors the steering wheel position when the toothed-wheel on the steering shaft passes through its magnetic field.

Steering wheel rotation (in degrees) is sent to the anti-lock brake system (ABS) module through circuit 8-CC18 (WH/RD) and circuit 10-CC17 (GY). Voltage is supplied by the ABS module through circuit 7-CC1 (YE/RD). Ground is provided by the ABS module through circuit 9-CC1 (BN/RD).

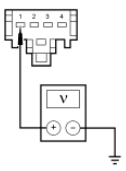
Possible Causes

- Sensor signal circuit 8-CC18 (WH/RD) open, short to ground, or short to voltage
- Sensor signal circuit 10-CC17 (GY) open, short to ground, or short to voltage
- Sensor power circuit 7-CC1 (YE/RD) open, short to ground, or short to voltage
- Sensor ground circuit 9-CC1 (BN/RD) open, short to ground, or short to voltage
- Steering wheel rotation sensor

PINPOINT TEST G: DTC C1277/C1278 — STEERING WHEEL ANGLE 1 AND 2 CIRCUIT FAILURE/FAULTED

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
G1 CARRY OUT THE RECALIBRATION PROCEDURE FOR THE STEERING WHEEL ROTATION SENSOR	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear the DTC.	**Yes** If DTC C1277 or C1278 is retrieved or the recalibration procedure indicates a fault, GO to G2 .

• Carry out the steering wheel rotation sensor recalibration procedure using the diagnostic tool. • Follow the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . • Enter the following diagnostic mode on the scan tool: Retrieve DTCs. • **Are any DTCs retrieved or does the recalibration procedure indicate a fault?**	If any other DTC is retrieved, GO to the ABS (With or Without Advance Trac®/IVD) Module Diagnostic Trouble Code (DTC) Index. **No** The ABS system is operating correctly. The DTC C1278 was meant for detection of steering wheel rotation sensor harness wiring problems at vehicle assembly time. The steering wheel rotation sensor circuit is checked for swapped wires (channel A and B). This DTC should not occur during repair unless the harness wiring to the steering wheel rotation sensor was changed or the PRNDL position indicator is not operating correctly. The DTC will occur only after driving a few feet and making a turn if the wiring problem or PRNDL problem exists.
G2 MONITOR THE STEERING ROTATION SENSOR PIDs	
• Ignition ON. • Monitor the steering rotation sensor PIDs while rotating the steering wheel clockwise and counterclockwise. • **Are the 2 PID values similar?**	**Yes** CLEAR the DTC. DRIVE the vehicle. RETRIEVE the DTCs. If DTC C1277 is present, INSTALL a new ABS control module. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test. **No** GO to G3 .
G3 CHECK THE VOLTAGE TO THE STEERING WHEEL ROTATION SENSOR	
• Ignition OFF. • Disconnect: Steering Wheel Rotation Sensor C226. • Ignition ON. • Measure the voltage between steering wheel rotation sensor C226-1, circuit 7-CC16A (YE/BK), harness side and ground.  A0057752 • **Is the voltage greater than 5 volts?**	**Yes** GO to G4 . **No** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
G4 CHECK THE STEERING WHEEL ROTATION SENSOR CIRCUITRY FOR AN OPEN	

<table>
<tr>
<td>
• Ignition OFF.
• Disconnect: ABS Module C155.
• Measure the resistance between ABS module C155 pins, harness side and steering wheel rotation sensor C226 pins, harness side as follows:
<table>
<tr><th>Steering Wheel Rotation Sensor C226 Pin</th><th>Circuit</th><th>ABS Module C155 Pin</th><th>Circuit</th></tr>
<tr><td>2</td><td>10-CC17 (GY)</td><td>6</td><td>10-CC17 (GY)</td></tr>
<tr><td>3</td><td>8-CC18 (WH/RD)</td><td>3</td><td>8-CC18 (WH/RD)</td></tr>
<tr><td>4</td><td>9-CC1 (BN/YE)</td><td>5</td><td>9-CC1 (BN/RD)</td></tr>
</table>
• Are the resistances less than 5 ohms?
</td>
<td>
Yes
GO to G5 .

No
REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
</td>
</tr>
<tr>
<td>G5 CHECK THE STEERING WHEEL ROTATION SENSOR FOR A SHORT TO VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>
• Ignition OFF.
• Connect: Steering Wheel Rotation Sensor C226.
• Disconnect: ABS Module C155.
• Ignition ON.
• Measure the voltage between ABS module C155 pins, harness side and ground as follows:
<table>
<tr><th>ABS Module C155 Pin</th><th>Circuit</th></tr>
<tr><td>6</td><td>10-CC17 (GY)</td></tr>
<tr><td>3</td><td>8-CC18 (WH/RD)</td></tr>
<tr><td>5</td><td>9-CC1 (BN/RD)</td></tr>
</table>
• Is any voltage present?
</td>
<td>
Yes
REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.

No
GO to G6 .
</td>
</tr>
<tr>
<td>G6 CHECK THE STEERING WHEEL ROTATION SENSOR CIRCUITRY FOR A SHORT TO GROUND</td>
<td></td>
</tr>
</table>

<table>
<tr>
<td>
• Ignition OFF.
• Measure the resistance between ABS module C155 pins, harness side and ground as follows:
<table>
<tr><th>ABS Module C155 Pin</th><th>Circuit</th></tr>
<tr><td>6</td><td>10-CC17 (GY)</td></tr>
<tr><td>3</td><td>8-CC18 (WH/RD)</td></tr>
<tr><td>5</td><td>9-CC1 (BN/RD)</td></tr>
</table>
• Is the resistance greater than 10,000 ohms?
</td>
<td>
Yes
INSTALL a new steering rotation sensor. REFER to Steering Wheel Rotation Sensor in this section. CLEAR the DTC. REPEAT the self-test.

No
REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
</td>
</tr>
</table>

Pinpoint Test H: DTC C1279, C1280, C1281, C1282, C2769, C2770 — Sensor Cluster Fault

Normal Operation

The accelerometer (lateral and longitudinal) and the yaw rate sensor are contained in the sensor cluster. The sensor measures the vehicle acceleration and yaw rate then sends the signal via CAN communication wires to the anti-lock brake system (ABS) module.

Voltage is supplied by circuit 7-CC1 (YE/RD). Ground is provided through circuit 9-CF67 (BN/RD). The controller area network (CAN) communication is transmitted through circuit 5-CF66 (BU/WH) and circuit 4-CF66 (GY/VT).

Possible Causes

- Power circuit 7-CC1 (YE/RD) open, short to ground, or short to power
- Ground circuit 9-CF67 (BN/RD) open, short to ground, or short to power
- CAN communication:
  - ♦ circuit 5-CF66 (BU/WH) open, short to ground, or short to power
  - ♦ circuit 4-CF66 (GY/VT) open, short to ground, or short to power

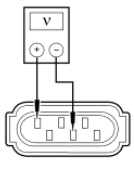
PINPOINT TEST H: DTC C1279, C1280, C1281, C1282, C2769, C2770 — SENSOR CLUSTER FAULT

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

NOTE: The yaw rate sensor and accelerometer are integral to the sensor cluster.

The sensor cluster is not serviceable and must be installed as an assembly.

Test Step	Result / Action to Take
H1 CARRY OUT THE YAW RATE SENSOR RECALIBRATION PROCEDURE	

• Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear DTCs. • Carry out the yaw rate sensor recalibration procedure using the diagnostic tool. • Enter the following diagnostic mode on the scan tool: Retrieve DTCs. • **Are any DTCs retrieved or does the recalibration procedure indicate a fault?**	**Yes** GO to H2 . **No** The ABS system is operating correctly.
H2 CHECK THE ABS MODULE YAW RATE PID	
• Monitor the ABS module yaw rate PID. • **Is the ABS module yaw rate PID value between -0.05 and 0.05?**	**Yes** GO to H4 . **No** RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. GO to H3 .
H3 REVERIFY THE ABS MODULE YAW RATE PID	
• Monitor the ABS module yaw rate PID. • **Is the ABS module yaw rate PID value between -0.05 and 0.05?**	**Yes** CHECK the ABS module connector for loose or corroded pins. CLEAR the DTC. REPEAT the self-test. **No** INSTALL a new yaw rate sensor. REFER to Yaw Rate Sensor in this section. CALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REPEAT the self-test.
H4 CHECK THE VOLTAGE FROM THE ABS MODULE	
• Ignition OFF. • Disconnect: The Yaw Rate Sensor C3073. • Ignition ON. • Measure the voltage between yaw rate sensor C3073-1, circuit 5-CF66 (BU/WH), harness side and yaw rate sensor C3073-5, circuit 9-CF67 (BN/RD), harness side.  A0057757 • **Is the voltage approximately 10 volts?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test. **No** GO to H5 .
H5 CHECK THE YAW RATE SENSOR CIRCUITRY FOR AN OPEN	

<table>
<tr>
<td>
• Ignition OFF.
• Disconnect: ABS Module C155.
• Measure the resistance between ABS module C155 pins, harness side and yaw rate sensor C3073 pins, harness side as follows:
<table>
<tr><th>ABS Module C155 Pin</th><th>Yaw Rate Sensor C3073 Pin</th><th>Circuit</th></tr>
<tr><td>7</td><td>3</td><td>7-CF67 (YE/RD)</td></tr>
<tr><td>5</td><td>5</td><td>9-CC1 (BN/RD)/9-CF67 (BN/RD)</td></tr>
<tr><td>25</td><td>1</td><td>5-CF66 (BU/WH)</td></tr>
<tr><td>29</td><td>2</td><td>4-CF66 (GY/VT)</td></tr>
</table>
• Is the resistance less than 5 ohms?
</td>
<td>
Yes
GO to H6 .

No
REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
</td>
</tr>
<tr>
<td>H6 CHECK THE YAW RATE SENSOR CIRCUITRY FOR A SHORT TO VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>
• Ignition ON.
• Measure the voltage between yaw rate sensor C3073 pins, harness side and ground as follows:
<table>
<tr><th>Yaw Rate Sensor C3073 Pin</th><th>Circuit</th></tr>
<tr><td>3</td><td>7-CF67 (YE/RD)</td></tr>
<tr><td>5</td><td>9-CF67 (BN/RD)</td></tr>
<tr><td>1</td><td>5-CF66 (BU/WH)</td></tr>
<tr><td>2</td><td>4-CF66 (GY/VT)</td></tr>
</table>
• Is voltage present?
</td>
<td>
Yes
REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.

No
GO to H7 .
</td>
</tr>
<tr>
<td>H7 CHECK THE YAW RATE SENSOR CIRCUITRY FOR A SHORT TO GROUND</td>
<td></td>
</tr>
</table>

<table>
<tr>
<td>
• Ignition OFF.
• Measure the resistance between the yaw rate sensor C3073 pins, harness side and ground as follows:
<table>
<tr><th>Yaw Rate Sensor C3073 Pin</th><th>Circuit</th></tr>
<tr><td>3</td><td>7-CF67 (YE/RD)</td></tr>
<tr><td>5</td><td>9-CF67 (BN/RD)</td></tr>
<tr><td>1</td><td>5-CF66 (BU/WH)</td></tr>
<tr><td>2</td><td>4-CF66 (GY/VT)</td></tr>
</table>
• Is the resistance greater than 10,000 ohms?
</td>
<td>
Yes
INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test.

No
REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
</td>
</tr>
</table>

Pinpoint Test I: DTC C1285 — Booster Solenoid Circuit Failure

Normal Operation

The active brake booster has internal solenoids that assist driver brake applications or can apply the brakes when needed if the vehicle loses control.

Power is supplied by circuit 8-CF68 (WH/RD). Ground is provided through circuit 9-CF68 (BN/RD).

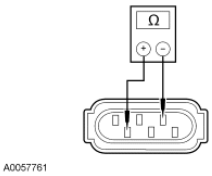
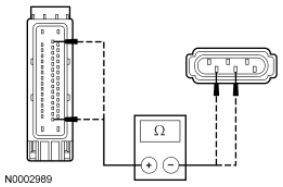
Possible Causes

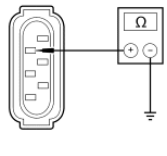
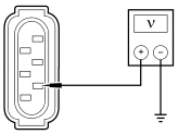
- Power circuit 8-CF68 (WH/RD) open
- Ground circuit 9-CF68 (BN/RD) open
- Active brake booster
- ABS module

PINPOINT TEST I: DTC C1285 — BOOSTER SOLENOID CIRCUIT FAILURE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
I1 CARRY OUT THE BRAKE BOOSTER RECALIBRATION PROCEDURE	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear DTC.	**Yes** If DTC C1285 is retrieved, or the brake booster portion of the recalibration procedure indicates a failure, GO to I2 .

• Carry out the brake booster recalibration procedure using the diagnostic tool. • Enter the following diagnostic mode on the scan tool: Retrieve DTCs. • **Are any diagnostic trouble codes (DTCs) retrieved or does the recalibration procedure indicate a fault?**	If any other DTC is retrieved, GO to the Anti-lock Brake System (ABS) (With or Without Advance Trac®/IVD) Module Diagnostic Trouble Code (DTC) Index. **No** The ABS system is operating correctly.
I2 CHECK THE BRAKE BOOSTER SOLENOID	
• Ignition OFF. • Disconnect: Brake Booster C149. • Measure the resistance between brake booster solenoid C149-3, component side and brake booster solenoid C149-4, component side.  A0057761 • **Is the resistance between 1 and 2 ohms?**	**Yes** GO to I3 . **No** INSTALL a new brake booster. REFER to Section 206-07 . CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
I3 CHECK CIRCUIT 8-CF68 (WH/RD) AND CIRCUIT 9-CF68 (BN/RD) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between ABS module C155-17, circuit 8-CF68 (WH/RD), harness side and brake booster C149-4, circuit 8-CF68 (WH/RD), harness side; and between ABS module C155-31, circuit 9-CF68 (BN/RD), harness side and brake booster C149-3, circuit 9-CF68 (BN/RD), harness side.  N0002989 • **Is the resistance less than 5 ohms?**	**Yes** GO to I4 . **No** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
I4 CHECK CIRCUIT 8-CF68 (WH/RD) FOR A SHORT TO GROUND	
• Measure the resistance between brake booster C149-4, circuit 8-CF68 (WH/RD), harness side and ground.	**Yes** GO to I5 . **No** REPAIR the circuit in question.

 A0057763 • **Is the resistance greater than 10,000 ohms?**	CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
I5 CHECK CIRCUIT 9-CF68 (BN/RD) FOR A SHORT TO VOLTAGE	
• Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between brake booster solenoid C149-3, circuit 9-CF68 (BN/RD), harness side and ground.  A0057773 • **Is voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test. **No** GO to I6 .
I6 CHECK THE BRAKE BOOSTER SOLENOID FOR CORRECT OPERATION	
• Connect: Brake Booster C149. • Start the engine. • Wait a few minutes to create engine vacuum in the brake booster and then place the ignition switch in the OFF position. • Connect a fused (10A) jumper wire between ABS module C155-31, circuit 9-CF68 (BN/RD), harness side and ground; and connect a fused (10A) jumper wire for several seconds between ABS module C155-17, circuit 8-CF68 (WH/RD), harness side and the positive battery post, while observing the brake pedal for movement. • **Does the brake pedal move?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test. **No** INSTALL a new brake booster. REFER to Section 206-07 . CLEAR the DTC. RECALIBRATE the ABS module. REPEAT the self-test.

Pinpoint Test J: DTC C1287 — Brake Booster Pedal Force Switch Circuit Failure

Normal Operation

The active brake booster has a normally open (NO) and a normally closed (NC) pedal force switch that operates according to driver brake applications.

The NO pedal force switch circuit is 8-CF51 (WH/GN). The NC pedal force switch circuit is 10-CF51 (GY/OG).

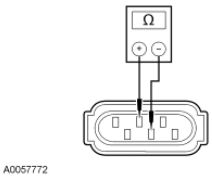
Possible Causes

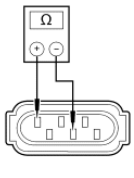
- NO pedal force switch circuit 8-CF51 (WH/GN) open, short to ground, or short to voltage

- NO pedal force switch circuit 10-CF51 (GY/OG) open, short to ground, or short to voltage
- Active brake booster
- Anti-lock brake system (ABS) module

PINPOINT TEST J: DTC C1287 — BRAKE BOOSTER PEDAL FORCE SWITCH CIRCUIT FAILURE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
J1 CARRY OUT THE BRAKE BOOSTER RECALIBRATION PROCEDURE	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear DTCs. • Carry out the brake booster recalibration procedure using the diagnostic tool. • Enter the following diagnostic mode on the scan tool: Retrieve DTCs. • **Are any DTCs retrieved or does the recalibration procedure indicate a fault?**	**Yes** If DTC C1287 is retrieved or the recalibration procedure indicates a fault, GO to J2 . If any other DTC, GO to the ABS (With or Without Advance Trac®/IVD) Module Diagnostic Trouble Code (DTC) Index. **No** The system is operating correctly.
J2 CHECK THE NORMALLY CLOSED RELEASE SWITCH	
• Ignition OFF. • Disconnect: Brake Booster C149. • Measure the resistance between brake booster C149-2, component side and brake booster C149-5, component side, while applying and releasing the brake pedal.  A0057772 • **Is the resistance less than 5 ohms with the brake pedal released and greater than 10,000 ohms with the brake pedal applied?**	**Yes** GO to J3 . **No** INSTALL a new brake booster. REFER to Section 206-07 . CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
J3 CHECK THE NORMALLY OPEN RELEASE SWITCH	

• Measure the resistance between brake booster C149-1, component side and brake booster C149-5, component side, while applying and releasing the brake pedal.  A0057375 • **Is the resistance less than 5 ohms with the brake pedal applied and greater than 10,000 ohms with the brake pedal released?**	**Yes** GO to J4 . **No** INSTALL a new brake booster. REFER to Section 206-07 . CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
J4 CHECK THE BRAKE BOOSTER CIRCUITRY FOR A SHORT TO VOLTAGE	
• Disconnect ABS Module C155 • Ignition ON. • Measure the voltage between brake booster C149 pins, harness side and ground, as follows: **Active Brake Booster C149** / **Circuit** 1 / 8-CF51 (WH/GN) 2 / 10-CF51 (GY/OG) 5 / 9-CF51 (BN/RD) • **Is voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. REPEAT the self-test. **No** GO to J5 .
J5 CHECK THE BRAKE BOOSTER CIRCUITRY FOR A SHORT TO GROUND	
• Measure the resistance between brake booster C149 pins and ground as follows: **Brake Booster Pin** / **Circuit** 1 / 8-CF51 (WH/GN) 2 / 10-CF51 (GY/OG)	**Yes** GO to J6 . **No** REPAIR the circuit in question. CLEAR the DTC(s). REPEAT the self-test.

5	9-CF51 (BN/GN)

- **Is the resistance greater than 10,000 ohms?**

J6 CHECK THE BRAKE BOOSTER CIRCUITRY FOR AN OPEN	
• Ignition OFF. • Measure the resistance between ABS module C155 pins, harness side and brake booster C149 pins, harness side as follows: • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-00 . REPEAT the self-test.

ABS Module C155 Pin	Brake Booster C149 Pin	Circuit
27	1	8-CF51 (WH/GN)
28	5	9-CF51 (BN/GN)
30	2	10-CF51 (GY/OG)

Pinpoint Test K: DTC C1288 — Brake Pressure Transducer Input Circuit Failure

Normal Operation

The brake pressure transducer sends current to the anti-lock brake system (ABS) module proportional to the driver's brake pedal application.

Reference voltage is supplied by circuit 7-CF64 (YE/BK). Ground is provided through circuit 9-CF64 (BN/YE). The transducer current is supplied by circuit 8-CF64 (WH/BK).

Possible Causes

- Reference voltage circuit 7-CF64 (YE/BK) open, short to ground, or short to voltage
- Ground circuit 9-CF64 (BN/YE) open, short to ground, or short to voltage
- Transducer signal circuit 8-CF64 (WH/BK) open, short to ground, or short to voltage
- Brake pressure transducer
- ABS module

PINPOINT TEST K: DTC C1288 — BRAKE PRESSURE TRANSDUCER INPUT CIRCUIT FAILURE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>K1 CHECK THE BRAKE PRESSURE TRANSDUCER CIRCUITRY FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: ABS Module C155.
• Disconnect: Brake Pressure Transducer C147.
• Ignition ON.
• Measure the voltage between ABS module C155 pins, harness side and ground as follows:

<table><tr><th>ABS Module C155 Pin</th><th>Circuit</th></tr><tr><td>18</td><td>7-CF64 (YE/BK)</td></tr><tr><td>19</td><td>9-CF64 (BN/YE)</td></tr><tr><td>20</td><td>8-CF64 (WH/BK)</td></tr></table>
• Is voltage present?</td><td>Yes
REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.

No
GO to K2 .</td></tr>
<tr><td>K2 CHECK THE BRAKE PRESSURE TRANSDUCER CIRCUITRY FOR A SHORT TO GROUND</td><td></td></tr>
<tr><td>• Ignition OFF.
• Measure the resistance between ABS module C155 pins, harness side and ground, as follows:

<table><tr><th>ABS Module C155 Pin</th><th>Circuit</th></tr><tr><td>18</td><td>7-CF64 (YE/BK)</td></tr><tr><td>19</td><td>9-CF64 (BN/YE)</td></tr><tr><td>20</td><td>8-CF64 (WH/BK)</td></tr></table>
• Are the resistances greater than 10,000 ohms?</td><td>Yes
GO to K3 .

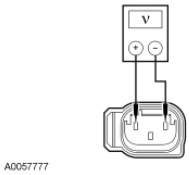
No
REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.</td></tr>
<tr><td>K3 CHECK THE BRAKE PRESSURE TRANSDUCER CIRCUITRY FOR AN OPEN</td><td></td></tr>
<tr><td>• Measure the resistance between ABS module C155 pins, harness side and brake pressure transducer C147 pins, harness side as follows:

<table><tr><th>ABS Module C155 Pin</th><th>Brake Pressure Transducer C147 Pin</th><th>Circuit</th></tr><tr><td>19</td><td>1</td><td>9-CF64 (BN/YE)</td></tr></table></td><td>Yes
GO to K4 .

No
REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.</td></tr>
</table>

20	2	8-CF64 (WH/BK)
18	3	7-CF64 (YE/BK)

- **Are the resistances less than 5 ohms?**

K4 CHECK THE ABS MODULE OUTPUT	
• Connect: ABS Module C155. • Ignition ON. • Measure the voltage between brake pressure transducer C147-3, circuit 7-CF64 (YE/BK), harness side and brake pressure transducer C147-1, circuit 9-CF64 (BN/YE), harness side.  A0057777 • **Is the voltage approximately 5 volts?**	**Yes** GO to K5 . **No** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test.
K5 CHECK THE BRAKE PRESSURE TRANSDUCER OUTPUT	
• Connect: Brake Pressure Transducer C147. • Disconnect: ABS Module C155. • Remove the ABS module C155-20, circuit 8-CF64 (WH/BK) from the harness connector. • Connect: ABS Module C155. • Ignition ON. • Measure the voltage between ABS module C155-20, with circuit 8-CF64 (WH/BK) removed from the harness connector and ground, while applying and releasing the brake pedal. • **Is the voltage between 0.125 and 0.375 volt with the brake pedal released and between 0.125 and 5 volts with the brake pedal applied?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test. **No** INSTALL a new brake booster. REFER to Section 206-07 . CLEAR the DTC. RECALIBRATE the ABS module. REPEAT the self-test.

Pinpoint Test L: DTC C1730 — Reference Voltage Out Of Range (+5 V)

Normal Operation

The 5-volt reference voltage is supplied by the anti-lock brake system (ABS) module.

Reference voltage is supplied by circuit 7-CF64 (YE/BK). The reference voltage circuit returns to the ABS module through the PTS switch circuit 9-CF65 (BN/WH) and the brake pressure transducer circuit 9-CF64 (BN/YE).

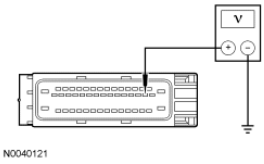
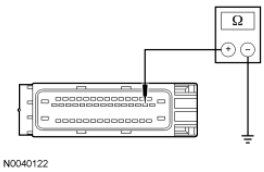
Possible Causes

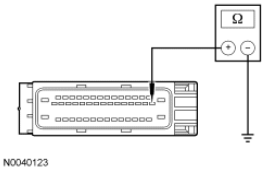
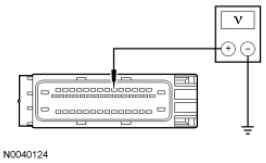
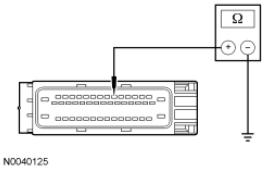
- Circuit 7-CF64 (YE/BK) short to ground or short to voltage

- Ground circuit 9-CF65 (BN/WH) short to ground or short to voltage
- Ground circuit 9-CF64 (BN/YE) short to ground or short to voltage
- Signal return (+) circuit 7-CC1 (YE/RD) short to ground or short to voltage
- Circuit 8-CF68 (WH/RD) short to ground
- ABS module
- IVD input/output components:
    - ♦ pedal travel switch (PTS) switch
    - ♦ brake pressure transducer

PINPOINT TEST L: DTC C1730 — REFERENCE VOLTAGE OUT OF RANGE (+5 V)

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
L1 CHECK CIRCUIT 7-CF64 (YE/BK) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ABS Module C155. • Disconnect: Brake Pressure Transducer C147. • Ignition ON. • Measure the voltage between ABS module C155-18, circuit 7-CF64 (YE/BK), harness side and ground.  N0040121 • **Is voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test. **No** GO to L2 .
L2 CHECK CIRCUIT 7-CF64 (YE/BK) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ABS module C155-18, circuit 7-CF64 (YE/BK), harness side and ground.  N0040122 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to L3 . **No** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.

L3 CHECK CIRCUIT 8-CF68 (WH/RD) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ABS module C155-17, circuit 8-CF68 (WH/RD), harness side and ground.  N0040123 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to L4 . **No** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
L4 CHECK CIRCUIT 7-CC1 (YE/RD) FOR A SHORT TO BATTERY	
• Disconnect: Yaw Rate Sensor C3073. • Ignition ON. • Measure the voltage between ABS module C155-7, circuit 7-CC1 (YE/RD), harness side and ground.  N0040124 • **Is voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test. **No** GO to L5 .
L5 CHECK CIRCUIT 7-CC1 (YE/RD) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ABS module C155-7, circuit 7-CC1 (YE/RD), harness side and ground.  N0040125 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to L6 . **No** REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test.
L6 CHECK THE ABS MODULE	
	Yes

• Connect: ABS Module C155. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear DTCs. • Enter the following diagnostic mode on the scan tool: Retrieve DTCs. • **Is DTC C1730 retrieved?**	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test. **No** GO to L7 .
L7 CHECK THE ADVANCE TRAC®/(IVD) COMPONENTS	
• Reconnect the brake pressure transducer C147, and the PTS C278, while clearing the DTCs and retrieving the DTCs in between each component being reconnected. • **Is DTC C1730 retrieved?**	**Yes** INSTALL a new brake booster. REFER to Section 206-07 . CLEAR the DTC. RECALIBRATE the ABS module. FOLLOW the diagnostic tool directions for the calibration procedure. REFER to Section 418-01 . REPEAT the self-test. **No** System is OK. REPEAT the self-test.

Pinpoint Test M: DTC C1960 — Driver Brake Apply Circuit Fault

Normal Operation

The 12-volt driver brake apply (DBA) signal is sent from the anti-lock brake system (ABS) module during brake application to the trailer tow relay (if equipped).

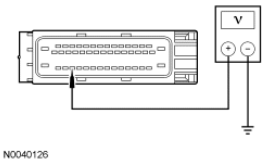
Voltage is supplied by circuit 29S-CF2 (OG/BU).

Possible Causes
- DBA signal circuit 29S-CF2 (OG/BU)
- ABS module

PINPOINT TEST M: DTC C1960 — DRIVER BRAKE APPLY CIRCUIT FAULT

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
M1 CHECK FOR OTHER DTCs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear DTCs. • Enter the following diagnostic mode on the scan tool: Retrieve DTCs. • **Is DTC C1960 retrieved?**	**Yes** GO to M2 . **No** If a different DTC is retrieved, GO to the ABS (With or Without Advance Trac®/IVD) Module Diagnostic Trouble Code (DTC) Index. If no DTCs are retrieved, system is OK.

M2 CHECK CIRCUIT 29S-CF2 (OG/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ABS Module C155. • Measure the voltage between the ABS module C155-44, circuit 29S-CF2 (OG/BU), harness side and ground.  N0040126 • **Is the voltage greater than 0 volts?**	**Yes** REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test. **No** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test.

Pinpoint Test N: The Advance Trac®/IVD Is Inoperative

Normal Operation

Engine torque modulation is achieved by regulating fuel and spark to the cylinders. The Advance Trac®/IVD system operates using the anti-lock brake system (ABS) module to interact with the powertrain control module (PCM) to reduce engine torque if one or both rear wheels lose traction and begin to spin during acceleration.

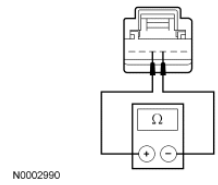
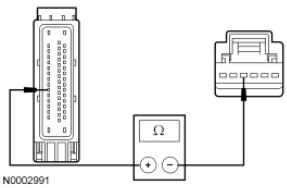
Voltage is supplied by circuit 20-CF54 (PK/WH).

Possible Causes
- Advance Trac®/IVD switch
- Power circuit 20-CF54 (PK/WH) open
- Power circuit 8-CF54 (WH/VT) open
- ABS module

PINPOINT TEST N: THE ADVANCE TRAC®/IVD IS INOPERATIVE

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
N1 CHECK FOR DTCs	
• Connect the scan tool. • Retrieve and document continuous DTCs. • **Are any DTCs retrieved?**	**Yes** GO to the ABS (With or Without Advance Trac®/IVD) Module Diagnostic Trouble Code (DTC) Index. **No**

	GO to N2 .
N2 CHECK THE Advance Trac®/IVD SWITCH	
• Disconnect: Advance Trac®/IVD Switch C3208. • Ignition OFF. • Press the Advance Trac®/IVD switch to the ON position. • Measure the resistance between Advance Trac®/IVD switch C3208-3, circuit 20-CF54 (PK/WH), component side and C3208-4, circuit 8-CF54 (WH/VT), component side.  N0002990 • **Is the resistance less than 5 ohms?**	**Yes** GO to N3 . **No** INSTALL a new Advance Trac®/IVD switch. TEST the system for normal operation.GO to N3 .
N3 CHECK CIRCUIT 8-CF54 (WH/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: ABS Module C155 . • Measure the resistance between ABS module C155-38, circuit 8-CF54 (WH/VT), harness side and Advance Trac®/IVD switch connector C3208-4, circuit 8-CF54 (WH/VT), harness side.  N0002991 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. **No** REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test O: Advance Trac®/IVD Switch Indicator Is Always On/Cannot Be Disabled

Normal Operation

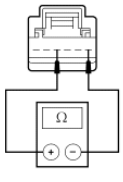
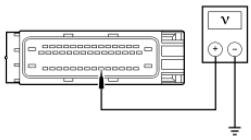
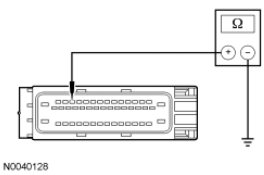
The traction control switch is a momentary switch, and when pressed disables or enables the traction control or Advance Trac®/IVD.

Voltage to the traction control switch is supplied by circuit 8-CF54 (WH/VT). The switch illumination off circuit is 31S-CF45 (BK/GN).

Possible Causes

- Advance Trac®/IVD switch
- Power circuit 8-CF54 (WH/VT) short to voltage
- Illumination circuit 31S-CF45 (BK/GN) short to ground
- Anti-lock brake system (ABS) module

PINPOINT TEST O: ADVANCE TRAC®/IVD CANNOT BE DISABLED/SWITCH INDICATOR IS ALWAYS ON

Test Step	Result / Action to Take
O1 CHECK THE Advance Trac®/IVD SWITCH	
• Disconnect: Advance Trac®/IVD Switch C3208. • Ignition OFF. • Measure the resistance between Advance Trac®/IVD switch C3208-1, circuit 31S-CF45 (BK/GN), component side and Advance Trac®/IVD switch C3208-4, circuit 8-CF54 (WH/VT), component side.  N0002992 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to O2 . **No** INSTALL a new Advance Trac®/IVD switch. TEST the system for normal operation.
O2 CHECK CIRCUIT 8-CF54 (WH/VT) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between ABS module C155-38, circuit 8-CF54 (WH/VT), harness side and ground.  N0040127 • **Is voltage present?**	**Yes** REPAIR the circuit. REPEAT the self-test. **No** GO to O3 .
O3 CHECK CIRCUIT 31S-CF45 (BK/GN) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ABS module C155-13, circuit 31S-CF45 (BK/GN), harness side and ground.  N0040128 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test. **No** REPAIR the circuit in question. REPEAT the self-test.

Pinpoint Test P: DTC C1440 — Pressure Transducer Input Circuit Failure

Normal Operation

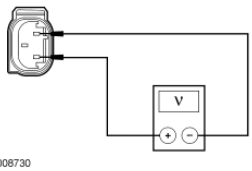
The pressure transducer transforms brake fluid pressures in the master cylinder to an electrical signal which the anti-lock brake system (ABS) module receives through circuit 8-CF64 (WH/BK). The transducer receives a 5-volt reference from the ABS module through circuit 7-CF64 (YE/BK). Circuit 9-CF64 (BN/YE) provides ground for the transducer.

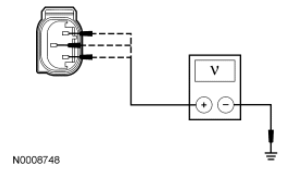
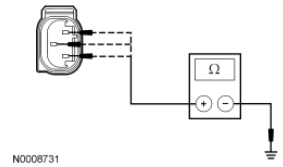
Possible Causes

- Power circuit 7-CF64 (YE/BK) open, short to ground, or short to voltage
- Ground circuit 9-CF64 (BN/YE) open, short to ground, or short to voltage
- Transducer signal circuit 8-CF64 (WH/BK) short to ground or short to voltage
- Pressure transducer
- ABS module

PINPOINT TEST P: DTC C1440 — PRESSURE TRANSDUCER INPUT CIRCUIT FAILURE

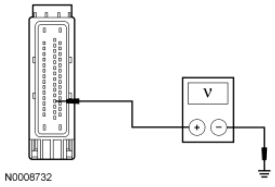
NOTE: Excessive clearance between brake pad and rotor, leaks, or air in the hydraulic brake system can also set DTC C1440.

Test Step	Result / Action to Take
P1 CHECK FOR DTCs	
• Ignition ON. • Connect the scan tool. • Retrieve the DTCs. • **Is DTC C1483, C1287, B2734, B2736, B2737, B2738 or B2740 present?**	**Yes** SERVICE these DTCs first. GO to the appropriate pinpoint test for each DTC received. **No** GO to P2 .
P2 CHECK FOR 5 VOLT REFERENCE VOLTAGE TO THE PRESSURE TRANSDUCER	
• Ignition OFF. • Disconnect: Pressure Transducer C147. • Ignition ON. • Measure the voltage between pressure transducer C147-1, circuit 9-CF64 (BN/YE), harness side and pressure transducer C147-3, circuit 7-CF64 (YE/BK), harness side.  N0008730 • **Is the voltage approximately 5 volts?**	**Yes** GO to P6 . **No** GO to P3 .

P3 CHECK CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between pressure transducer C147-3, circuit 7-CF64 (YE/BK), harness side and ground; and between pressure transducer C147-1, circuit 9-CF64 (BN/YE), harness side and ground; and between pressure transducer C147-2, circuit 8-CF64 (WH/BK), harness side and ground.  N0008748 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test. **No** GO to P4 .
P4 CHECK CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between pressure transducer C147-3, circuit 7-CF64 (YE/BK), harness side and ground; between pressure transducer C147-1, circuit 9-CF64 (BN/YE), harness side and ground; and between pressure transducer C147-2, circuit 8-CF64 (WH/BK), harness side and ground.  N0008731 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to P5 . **No** REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.
P5 CHECK CIRCUIT RESISTANCE	
• Measure the resistance between ABS module C155 and pressure transducer C147 pins. • **Is the resistance less than 5 ohms?**	**Yes** GO to P6 . **No** REPAIR the circuit in question. CLEAR the DTC. REPEAT the self-test.

ABS Module C155	Pressure Transducer C147	Circuit
Pin 18	Pin 3	7-CF64 (YE/BK)
Pin 20	Pin 2	8-CF64 (WH/BK)
Pin 19	Pin 1	9-CF64 (BN/YE)

P6 CHECK THE SIGNAL FROM THE PRESSURE TRANSDUCER	

• Connect: Pressure Transducer C147. • Disconnect: ABS Module C155-20, circuit 8-CF64 (WH/BK). • Connect: ABS Module C155. • Ignition ON. • Measure the voltage between ABS C155-20, circuit 8-CF64 (WH/BK), harness side and ground while applying and releasing the brake pedal.  • **Is any voltage present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. **No** INSTALL a new pressure transducer. CLEAR the DTC. REPEAT the self-test.

Pinpoint Test Q: DTC C1969 — Traction Control/Yaw Rate Control Switch Circuit

Normal Operation

The traction control switch is a momentary switch and when pressed, disables or enables the traction control or Advance Trac®/IVD.

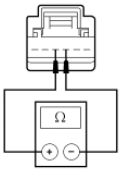
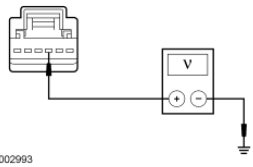
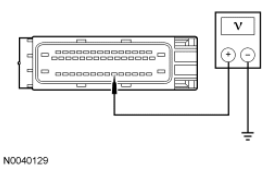
Power is supplied by circuit 20-CF54 (PK/WH). Circuit 8-CF54 (WH/VT) provides the switch input signal to the ABS module. Current to the disable LED lamp from the ABS module is supplied by circuit 31S-CF45 (BK/GN).

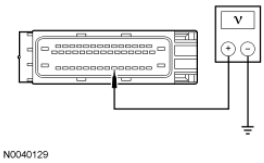
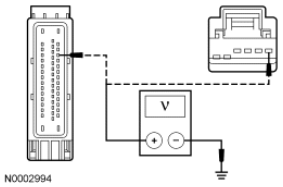
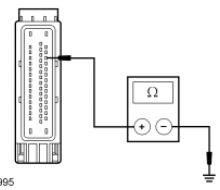
Possible Causes

- Traction Control/Advance Trac®/IVD switch
- Power circuit 20-CF54 (PK/WH)
- Switch signal circuit 8-CF54 (WH/VT) short to voltage
- LED lamp circuit 31S-CF45 (BK/GN) short to ground or short to voltage
- ABS module

PINPOINT TEST Q: DTC C1969 — TRACTION CONTROL/YAW CONTROL SWITCH CIRCUIT FAULT

Test Step	Result / Action to Take
Q1 CHECK FOR DTCs	
• Connect the scan tool. • Retrieve and document continuous DTCs. • **Are any DTCs retrieved?**	**Yes** GO to the ABS Module Diagnostic Trouble Code (DTC) Index. **No** GO to Q2 .
Q2 CHECK THE ADVANCE TRAC®/IVD SWITCH	

• Disconnect: Advance Trac®/IVD Switch C3208. • Ignition OFF. • Press and hold the Advance Trac®/IVD switch in the ON position. • Measure the resistance between Advance Trac®/IVD switch C3208-4, circuit 8-CF54 (WH/VT), component side and between the Advance Trac®/IVD switch C3208-3, circuit 20-CF54 (PK/WH), component side.  N0002990 • **Is the resistance greater than 5 ohms?**	**Yes** INSTALL a new Advance Trac®/IVD switch. TEST the system for normal operation. **No** GO to Q3 .
Q3 CHECK THE VOLTAGE TO THE ADVANCE TRAC®/IVD SWITCH	
• Ignition ON. • Measure the voltage between Advance Trac®/IVD switch C3208-3, circuit 20-CF54 (PK/WH), harness side and ground.  N0002993 • **Is the voltage greater than 10 volts?**	**Yes** GO to Q4 . **No** REPAIR the circuit in question. TEST the system for normal operation.
Q4 CHECK THE ADVANCE TRAC®/IVD SWITCH INPUT	
• Ignition OFF. • Connect: Advance Trac®/IVD Switch C3208. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between ABS module C155-38, circuit 8-CF54 (WH/VT), harness side and ground while pressing the Advance Trac®/IVD switch ON.  N0040129	**Yes** RELEASE the Advance Trac®/IVD switch. If the voltage drops to less than 2 volts, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. GO to Q5 . **No** REPAIR the circuit in question. TEST the system for normal operation.

• **Is the voltage greater than 10 volts?**	
Q5 CHECK CIRCUIT 8-CF54 (WH/VT) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between ABS module C155-38, circuit 8-CF54 (WH/VT), harness side and ground.  N0040129 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTC. REPEAT the self-test. **No** GO to Q6 .
Q6 CHECK CIRCUIT 31S-CF45 (BK/GN) FOR A SHORT TO VOLTAGE	
• Measure the voltage between ABS module C155-13, circuit 31S-CF45 (BK/GN), harness side and ground; and between Advance Trac®/IVD switch C3208-1, circuit 31S-CF45 (BK/GN), harness side and ground.  N0002994 • **Is voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to Q7 .
Q7 CHECK CIRCUIT 31S-CF45 (BK/GN) FOR A SHORT TO GROUND	
• Measure the resistance between ABS module C155-13, circuit 31S-CF45 (BK/GN), harness side and ground.  N0002995 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test R: DTC C1998 — Module Calibration Not Complete

Normal Operation

The Advance Trac®/IVD system needs to be recalibrated whenever a component specific to the system is disconnected or a new component is installed.

Possible Causes

- Disconnected/reconnected Advance Trac®/IVD component:
  - ♦ module
  - ♦ yaw rate sensor/accelerometer
  - ♦ steering wheel rotation sensor
- Clearing of Advance Trac®/IVD component related DTCs. (Refer to the Calibration List of DTCs)

PINPOINT TEST R: DTC C1998 — MODULE CALIBRATION NOT COMPLETE

NOTE: The Advance Trac®/IVD lamp will flash when a system calibration is required. Calibration is required after certain DTCs are cleared.

NOTE: Make sure the vehicle is not on a hoist and is sitting on level ground before performing stability assist module calibration.

Test Step	Result / Action to Take
R1 CHECK FOR DTCs	
• Connect the scan tool. • Ignition ON. • Retrieve DTCs. • **Is any other DTC retrieved with C1998?**	**Yes** GO to the appropriate pinpoint test for the DTC. Some of the pinpoint tests recommend IVD calibration prior to any further diagnostics, in this case, GO to R2 . **No** GO to R2 .
R2 ADVANCE TRAC®/IVD CALIBRATION	
• Connect the scan tool. • Ignition ON. • **NOTE:** Be sure to rotate the steering wheel lock-to-lock during the calibration of the ABS system. • With the engine running carry out the Advance Trac®/IVD calibration per the diagnostic tool instructions. • **Did calibration complete for all IVD sensors? And did the Advance Trac®/IVD lamp stop flashing and go off?**	**Yes** GO to R3 . **No** GO to R4 . Some concerns will cause a calibration not complete. If sent here from another pinpoint test, return to that pinpoint test for further diagnostics.
R3 CLEAR DTC C1998	
NOTE: Clear DTC C1998 after completing the calibration.	**Yes** TEST DRIVE the vehicle. REPEAT the self-test. If sent here from another pinpoint test, return to

• Connect the scan tool. • Ignition ON. • Clear the DTC. • **Did the DTC clear?**	that pinpoint test for further diagnostics. **No** GO to R4 .
R4 MONITOR THE STEERING POSITION SENSOR PIDS	
• Ignition ON. • Monitor the anti-lock brake system (ABS) module steering position sensor PIDS while rotating the steering wheel clockwise and counterclockwise. • **Are the 2 steering position sensor PID values switching as the wheel rotates?**	**Yes** GO to Pinpoint Test H . **No** GO to Pinpoint Test G .

Pinpoint Test S: DTCs C2777 and C2778 — Sensor Cluster Bus Failure

Normal Operation

The accelerometer (lateral and longitudinal) and the yaw rate sensor are contained in the stability control sensor cluster. The sensor cluster monitors the vehicle acceleration and yaw rate, then sends the signal along a dedicated controller area network (CAN) bus to the ABS module, circuits 4-CF66 (GY/VT) and 5-CF66 (BU/WH). The sensor cluster receives 12 volts from the ABS module along circuit 7-CF67 (YE/RD), the steering wheel rotation sensor also receives this voltage in series with the sensor cluster. Ground (or sensor return) for the sensor cluster is provided through the ABS module along circuit 9-CF67 (BN/RD), the steering wheel rotation sensor also shares this ground with the sensor cluster in series.

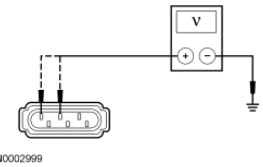
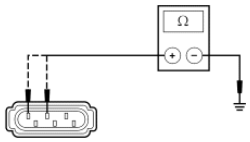
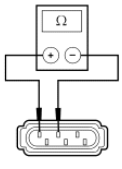
Possible Causes

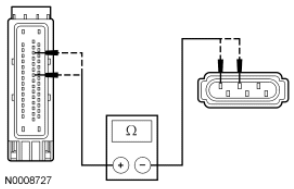
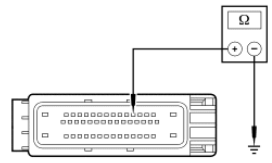
- Power circuit 7-CF67 (YE/RD) open, short to ground, or short to power
- Ground circuit 9-CF67 (BN/RD) open, short to ground, or short to power
- Steering wheel rotation sensor
- Circuit 4-CF66 (GY/VT)
- Circuit 5-CF66 (BU/WH)
- Sensor cluster
- Anti-lock brake system (ABS) module

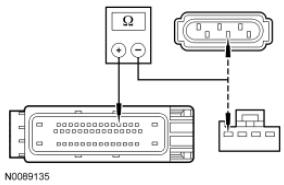
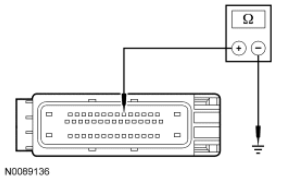
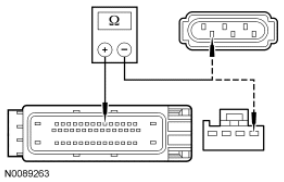
PINPOINT TEST S: DTCs C2777 AND C2778 — SENSOR CLUSTER BUS FAILURE

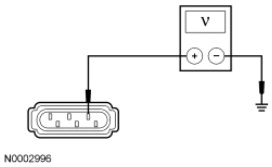
NOTE: Measure all pins of the sensor cluster and ABS module when removing connectors. Care should be taken when reinstalling these connectors.

Test Step	Result / Action to Take
S1 CHECK THE CAN BUS CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Sensor Cluster C3073. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between ground and:	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. CALIBRATE the system. REPEAT the self-test. **No** GO to S2 .

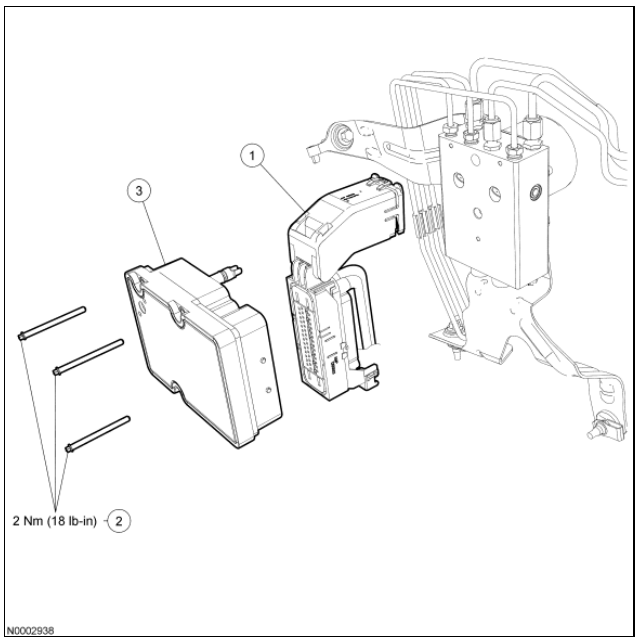
♦ sensor cluster C3073-1, circuit 5-CF66 (BU/WH), harness side. ♦ sensor cluster C3073-2, circuit 4-CF66 (GY/VT), harness side.  N0002999 • **Is any voltage present?**	
S2 CHECK THE CAN BUS CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ground and: ♦ sensor cluster C3073-1, circuit 5-CF66 (BU/WH), harness side. ♦ sensor cluster C3073-2, circuit 4-CF66 (GY/VT), harness side.  N0008725 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S3 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. CALIBRATE the system. REPEAT the self-test.
S3 CHECK THE CAN BUS CIRCUITS FOR A SHORT TOGETHER	
• Measure the resistance between the sensor cluster C3073-1, circuit 5-CF66 (BU/WH), harness side and sensor cluster C3073-2, circuit 4-CF66 (GY/VT), harness side.  N0008726 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S4 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. CALIBRATE the system. REPEAT the self-test.
S4 CHECK THE CAN BUS CIRCUITS FOR AN OPEN	

• Measure the resistance between: ♦ sensor cluster C3073-1, circuit 5-CF66 (BU/WH), harness side and ABS module C155-25, circuit 5-CF66 (BU/WH), harness side. ♦ sensor cluster C3073-2, circuit 4-CF66 (GY/VT), harness side and ABS module C155-29, circuit 4-CF66 (GY/VT), harness side.  N0008727 • **Are the resistances less than 5 ohms?**	**Yes** GO to S5 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. CALIBRATE the system. REPEAT the self-test.
S5 CHECK THE SENSOR RETURN CIRCUIT FOR A SHORT TO GROUND	
• Disconnect: Steering Wheel Rotation Sensor C226. • Measure the resistance between ABS module C155-5, circuit 9-CC1 (BN/RD), harness side and ground.  N0089134 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S6 . **No** REPAIR the circuit. CLEAR the DTCs. CALIBRATE the system. REPEAT the self-test.
S6 CHECK THE SENSOR RETURN CIRCUIT FOR AN OPEN	
• Measure the resistance between ABS module C155-5, circuit 9-CC1 (BN/RD), harness side and: ♦ sensor cluster C3073-5, 9-CF67 (BN/RD), harness side. ♦ steering wheel rotation sensor C226-4, 9-CC16 (BN/YE), harness side.	**Yes** GO to S7 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. CALIBRATE the system. REPEAT the self-test.

 N0089135 • **Are the resistances less than 5 ohms?**	
S7 CHECK THE SENSOR VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND	
• Measure the resistance between ABS module C155-7, circuit 7-CC1 (YE/RD), harness side and ground.  N0089136 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S8 . **No** REPAIR the circuit. CLEAR the DTCs. CALIBRATE the system. REPEAT the self-test.
S8 CHECK THE SENSOR VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
• Measure the resistance between ABS module C155-7, circuit 7-CC1 (YE/RD), harness side and: ♦ sensor cluster C3073-3, 7-CF67 (YE/RD), harness side. ♦ steering wheel rotation sensor C226-1, 7-CC16A (YE/BK), harness side.  N0089263 • **Are the resistances less than 5 ohms?**	**Yes** GO to S9 . **No** REPAIR the circuit. CLEAR the DTCs. RECALIBRATE the system. REPEAT the self-test.
S9 CHECK THE SENSOR VOLTAGE SUPPLY FROM THE ABS MODULE	
• Connect: ABS Module C155. • Ignition ON. • Measure the voltage between sensor cluster C3073-3, circuit 7-CF67 (YE/RD), harness side and ground.	**Yes** INSTALL a new yaw rate sensor. REFER to Yaw Rate Sensor in this section. CLEAR the DTCs. CALIBRATE the system. TEST DRIVE the vehicle. REPEAT the self-test. **No** INSTALL a new ABS module. REFER to

 N0002996 • **Is the voltage greater than 10 volts?**	Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. CONFIGURE the ABS module. CALIBRATE the system. REPEAT the self-test.

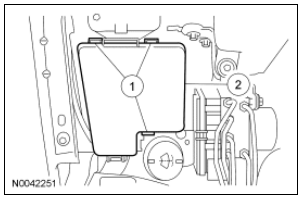
Anti-Lock Brake System (ABS) Module



Item	Part Number	Description
1	—	Anti-lock brake system (ABS) module electrical connector
2	2M101	ABS module bolts (3 required)
3	2C219	ABS module

Removal and Installation

1. Position the battery junction box (BJB) aside.
    1. Release the clips.
    2. Position the BJB aside.



2. Disconnect the ABS electrical connector.

3. Remove the 3 ABS module screws and the ABS module.
    - To install, tighten to 2 Nm (18 lb-in).

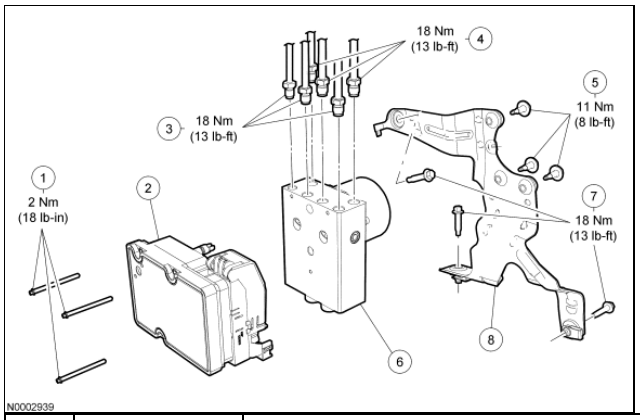
4. **NOTE:** Use the diagnostic tool to configure the ABS module. For additional information, refer to Section 418-01 .

    To install, reverse the removal procedure.

Hydraulic Control Unit (HCU)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CPM-1)	WSS-M6C62-A



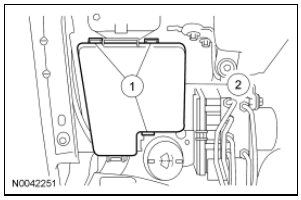
Item	Part Number	Description
1	2M101	Anti-lock brake system (ABS) module-to-HCU bolts (3 required)
2	2C219	Anti-lock brake system (ABS) module
3	2C292	Brake line nuts-to-HCU (M10) (3 required)
4	2C326	Brake line nuts-to-HCU (M12) (3 required)
5	3B676	HCU bracket-to-HCU bolts (3 required)
6	2C286	HCU
7	2C348	HCU bracket-to-body bolts (3 required)
8	2C304	HCU bracket

Removal and Installation

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in personal injury.

NOTICE: **Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.**

1. Position the battery junction box (BJB) aside.
    1. Release the clips.
    2. Position the BJB aside.



2. Remove the 3 bolts and position the ABS module aside.
    - To install, tighten to 2 Nm (18 lb-in).

3. **NOTE:** The brake lines must be installed in the same location as removed.

   Remove the 3 brake line nuts-to-HCU (M10) and position the brake lines aside.

    - To install, tighten to 18 Nm (13 lb-ft).

4. **NOTE:** The brake lines must be installed in the same location as removed.

   Remove the 3 brake line nuts-to-HCU (M12) and position the brake lines aside.

    - To install, tighten to 18 Nm (13 lb-ft).

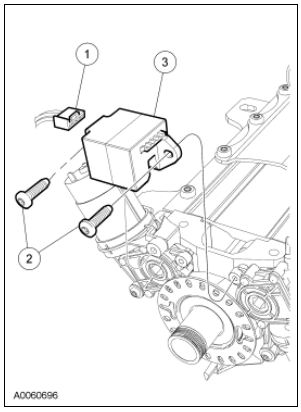
5. Remove the 3 HCU bracket-to-HCU bolts and the HCU assembly.
    - To install, tighten to 11 Nm (8 lb-ft).

6. Remove the 3 HCU bracket-to-body bolts and the HCU bracket.
    - To install, tighten to 18 Nm (13 lb-ft).

7. To install, reverse the removal procedure.
    - Bleed the brake system. For additional information, refer to Section 206-00 .

Steering Wheel Rotation Sensor

Removal and Installation



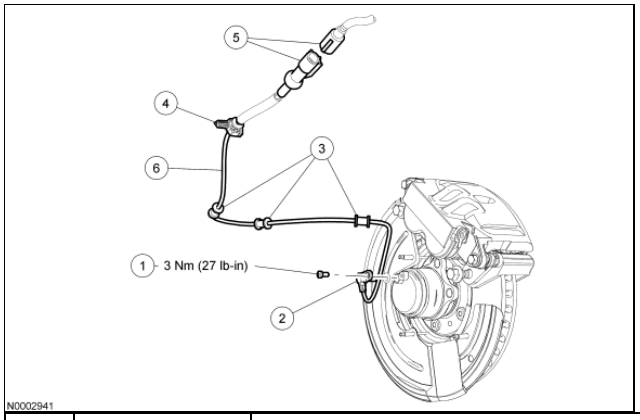
Item	Part Number	Description
1	—	Steering wheel rotation sensor electrical connector
2	—	Screws (2 required)
3	3F818	Steering wheel rotation sensor

1. Disconnect the steering wheel rotation sensor electrical connector.
2. Remove the 2 screws and the steering wheel rotation sensor.
3. To install, reverse the removal procedure.

Wheel Speed Sensor — Front

Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



Item	Part Number	Description
1	W709792-S	Wheel speed sensor bolt
2	2C204	Wheel speed sensor
3	—	Wheel speed sensor harness retainer (part of 2C190)
4	—	Wheel speed sensor harness pin-type retainer (part of 2C190)
5	—	Wheel speed sensor electrical connector
6	2C190	Wheel speed sensor harness

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** Make sure the wheel speed sensor is fully seated before installation of the new bolt.

   Remove the wheel speed sensor bolt.

   - To install, tighten to 3 Nm (27 lb-in).

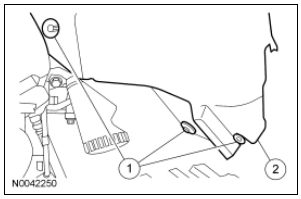
3. **NOTE:** Install a new O-ring.

   Remove the wheel speed sensor.

4. Remove the 3 wheel speed sensor harness retainers.

5. Remove the wheel speed sensor harness pin-type retainers.

6. Gain access to the wheel speed sensor harness.
    1. Remove the pin-type retainers.
    2. Position the inner splash shield aside.



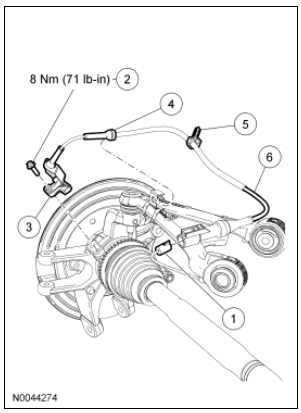
7. Disconnect the wheel speed sensor electrical connector.

8. **NOTE:** Apply a 2.5 mm (0.1 in) bead of sealant to the outside diameter of the wheel speed sensor.

   Remove the wheel speed sensor and the harness.

9. To install, reverse the removal procedure.

Wheel Speed Sensor — Rear



Item	Part Number	Description
1	14407	Wheel speed sensor electrical connector
2	W500212-S	Wheel speed sensor bolt
3	2C381	Wheel speed sensor
4	—	Wheel speed sensor harness retainer (part of 2C190) (3 required)
5	—	Wheel speed sensor harness pin-type retainer (part of 2C190)
6	2C190	Wheel speed sensor harness

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the wheel speed sensor electrical connector.

3. Remove the wheel speed sensor bolt.
   - To install, tighten to 8 Nm (71 lb-in).

4. **NOTE:** Clean off all dirt and foreign material that may have collected around the rear anti-lock brake sensor before removal.

   Remove the wheel speed sensor.

5. Remove the wheel speed sensor harness retainer.

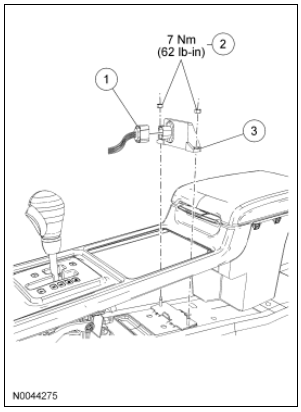
6. Remove the wheel speed sensor harness pin-type retainer.

7. Remove the wheel speed sensor and harness assembly.

8. To install, reverse the removal procedure.

Yaw Rate Sensor

Removal and Installation



Item	Part Number	Description
1	2C011	Yaw rate sensor electrical connector
2	W700101-S	Yaw rate sensor bracket nuts (2 required)
3	3C296	Yaw rate sensor

NOTE: When installing a new yaw rate sensor, the anti-lock brake system (ABS) module must be configured (using vehicle as-built data) and calibrated. Follow the diagnostic tool directions for the calibration procedures. For module configuration, refer to Section 418-01 .

1. If equipped, remove the floor console. For additional information, refer to Section 501-12 .

2. **NOTE:** Fold back the carpeting flap to gain access to the yaw rate sensor.

   Disconnect the yaw rate sensor electrical connector.

3. Remove the 2 nuts and the yaw rate sensor.
   - To install, tighten to 7 Nm (62 lb-in).

4. To install, reverse the removal procedure.

General Specifications

Item	Specification
	Fluid
CAUTION: Use only MERCON® V transmission fluid. Use of any other fluids may result in transmission failure. • Normal maintenance ♦ Fluid change not necessary, filled for life. • Severe duty maintenance ♦ Change the fluid at 48,000 km (30,000 miles) intervals.	
MERCON ® V Automatic Transmission Fluid XT-5-QM	MERCON ® V
Fluid Capacity	
NOTE: Approximate dry capacity includes cooler and tubes. Fluid level procedures in this section should be used to determine actual fluid requirements and fluid specification. DO NOT OVERFILL. If it is necessary to add or change fluid, use only fluid which has been certified by the supplier as meeting the Ford Motor Company specification shown.	
3.9L engine	11.2L (11.9 quarts)
Fluid Filter	
In-Line Transmission Fluid Filter Kit 7B155	—
In-Line Transmission Fluid Filter 7B155	—
Lubricant	
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B
Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B

End Play Specifications

Transmission Overdrive End Play Dimension D	Select Thrust Washer (No. 1 Nylon)		ID: Color
	Part Number	Thickness	
38.05-38.13 mm (1.498-1.501 in)	F7TZ-TA	1.55-1.60 mm (0.061-0.063 in)	White
38.14-38.23 mm (1.50-1.51 in)	F7TZ-MA	1.75-1.80 mm (0.069-0.071 in)	Green
38.29-38.42 mm (1.507-1.513 in)	F7TZ-NA	1.85-1.90 mm (0.073-0.075 in)	Red
38.43-38.61 mm (1.51-1.52 in)	F7TZ-RA	2.05-2.10 mm (0.081-0.083 in)	Black
38.62-38.74 mm (1.52-1.53 in)	F7TZ-SA	2.15-2.20 mm (0.095-0.097 in)	Yellow

End Play Specifications

Rear (No. 4) Dimension E	Selective Needle Bearings (No. 4)		ID: Notches
	Part Number	Thickness	
1.67-1.85 mm (0.066-0.073 in)	XW4Z-7D014-CA	2.65-2.80 mm (0.104-0.110 in)	0
1.86-2.04 mm (0.073-0.080 in)	XW4Z-7D014-DA	2.80-2.95 mm (0.110-0.116 in)	1
2.05-2.23 mm (0.081-0.088 in)	XW4Z-7D014-EA	3.00-3.15 mm (0.118-0.124 in)	2
2.25-2.43 mm (0.089-0.096 in)	XW4Z-7D014-FA	3.20-3.35 mm (0.126-0.132 in)	3

Shift Speeds

⚠ CAUTION: Always obey local traffic laws, do not exceed posted limits.

Throttle Position	D5 Position	Shift Speed
	Shift	Axle Ratio—All
Closed	5-4	35-42 km/h (22-26 mph)
	4-3	6-10 km/h (4-6 mph)
	3-2	6-10 km/h (4-6 mph)
	2-1	10-15 km/h (6-9 mph)
Minimum	1-2	13-16 km/h (8-10 mph)
Monitor PID:	2-3	21-26 km/h (13-16 mph)
TP volt 1.25	3-4	29-35 km/h (18-22 mph)
	4-5	40-45 km/h (25-28 mph)
Wide	1-2	64-74 km/h (40-46 mph)
Open	2-3	93-101 km/h (58-63 mph)
	3-4	140-148 km/h (87-92 mph)
	4-5	195-206 km/h (121-128 mph)

Band Adjustment and Torque Chart

Description	Number of Turns to Back Off	Locknut		Adjusting Screw	
		Nm	Lb-Ft	Nm	Lb-Ft
Intermediate Band	1.5	54	40	14	10
Overdrive Band	1.5	54	40	14	10

Selective Snap Rings

Coast and Direct Clutch Drum				
Part Number	Thickness		Diameter	
	mm	inch	mm	inch

E860126-S	1.37	0.0539	130.1	5.122
E860127-S	1.73	0.0681	130.1	5.122
E860128-S	2.08	0.0819	130.1	5.122
E860129-S	2.44	0.0961	130.1	5.122

Selective Snap Rings

Forward Clutch Cylinder				
Part Number	Thickness		Diameter	
	mm	inch	mm	inch
XW4Z-7D483-AB	1.73	0.0681	141.45	5.56
XW4Z-7D483-AC	2.08	0.0819	141.45	5.56
XW4Z-7D483-AD	2.44	0.0961	141.45	5.56

Service Identification Model Chart

Vehicle Application			
7000 Prefix and Suffix	C=Column F=Floor	Engine Displacement	Vehicle Application
6W4P-AB	F	3.9L	Lincoln LS

Solenoid Operation Chart

Base Gearshift Selector Position	PCM Comm- anded Gear	5R55S Solenoid States						
		SSA	SSB	SSC	SSD	PCA	PCB	PCC
P	P	ON	OFF	OFF	ON	L	H/L	L
N	N	ON	OFF	OFF	ON	L	H/L	L
R	R	ON	OFF	OFF	ON	L/H	L	H
D5	1	ON	OFF	OFF	ON	H	H/L	L
	2	ON	OFF	ON	ON	L/H	H	L
	3	ON	ON	OFF	ON	H	L/H	L
	4	OFF	OFF	OFF	ON	H	H/L	H
	5	OFF	OFF	ON	ON	H	H	H
D4	1	ON	OFF	OFF	ON	H	H/L	L
	2	ON	OFF	ON	ON	L/H	H	L
	3	ON	ON	OFF	ON	H	L/H	L
	4	OFF	OFF	OFF	OFF	L/H	H	H
SST +/-	1	ON	OFF	OFF	ON	H	H/L	L
	2	ON	OFF	ON	ON	L/H	H	L

	3	ON	ON	OFF	ON	H	L/H	L
	4	OFF	OFF	OFF	ON	H	L/H	H
	5	OFF	OFF	ON	ON	H	H	H
Manual 3	3	ON	ON	OFF	OFF	H	L	H/L
Manual 2	2	ON	OFF	ON	OFF	H	L	H/L
Manual 1	1	ON	OFF	OFF	OFF	H	L	H/L

H = HIGH

L = LOW

H/L = PCM controlled

Manual = if equipped

Band/Clutch Application Chart A

	Overdrive Band	Interme- diate Band	Reverse Band	Forward Clutch	Direct Clutch	Coast Clutch
Reverse			A [a]		A [a]	
1st				A [a]		
2nd	A			A [a]		
3rd		A [a]		A [a]		
4th				A [a]	A [a]	
5th	A [a]			A [a]	A [a]	
1st [b]				A [a]		
2nd [b]	A [a]			A [a]		
3rd [b]		A [a]		A [a]		
4th [b]				A [a]	A [a]	Ac [c]
Manual 3rd		Ac [c]		A [a]		Ac [c]
Manual 2nd	A [a]		Ac [c]	A [a]		
Manual 1st			Ac [c]	A [a]		Ac [c]

[a] A = Applied
[b] D4 Position (overdrive cancelled)
[c] Ac = Applied to carry coast torque

Band/Clutch Application Chart B

	Direct One-Way Clutch		Low One-Way Clutch		Engine Braking
	Drive	Coast	Drive	Coast	
Reverse	H [a]	OR [b]	NE [c]		NO

1st	H [a]	OR [b]	H [a]	OR [b]	NO
2nd	OR [b]	OR [b]	H [a]	OR [b]	NO
3rd	H [a]	OR [b]	OR [b]	OR [b]	NO
4th	H [a]	OR [b]	OR [b]	OR [b]	NO
5th	OR [b]	OR [b]	OR [b]	OR [b]	YES
1st [d]	H [a]	OR [b]	H [a]	OR [b]	YES
2nd [d]	OR [b]	OR [b]	H [a]	OR [b]	YES
3rd [d]	H [a]	OR [b]	OR [b]	OR [b]	YES
4th [d]	H [a]	OR [b]	OR [b]	OR [b]	YES
Manual 3rd	H [a]	OR [b]	OR [b]	OR [b]	YES
Manual 2nd	OR [b]	OR [b]	H [a]	OR [b]	YES
Manual 1st	H [a]	OR [b]	H [a]	OR [b]	YES

[a] H = Hold
[b] OR = Overrunning
[c] NE = No effect
[d] D4 Position (overdrive cancelled)

Line Pressure Chart

Range	Idle Pressure		WOT Stall Pressure	
	PC C	Line	PC C	Line
P/N	1-103 kPa (0-15 psi)	862-1,137 kPa (125-165 psi)		
R	758-862 kPa (110-125 psi)	965-1,551 kPa (140-225 psi)	758-862 kPa (110-125 psi)	2,000-2,482 kPa (290-360 psi)
D5	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)
D4	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)
M5/M4	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)
M3	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)
M2/M1	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)

Stall Speed Chart

Vehicle	Engine	RPM
Lincoln LS	3.9L	2,268-2,677

Torque Specifications

Description	Nm	lb-ft	lb-in
Case-to-center support bolt	11	8	—
Digital transmission range (TR) sensor-to-case screws	8	—	71
Transmission output shaft flange coupler bolts and nuts	81	60	—
Extension housing screws and studs	30	22	—
Fluid level indicator plug-to-drain pipe assembly	10	—	89
Fluid pan drain plug	26	19	—
Fluid pump housing screws	22	16	—
Heat shield screws	10	—	89
Locknut for band adjustment	54	40	—
Main control-to-case screws	10	—	89
Manual control valve detent spring-to-case screw	10	—	89
Manual control lever shaft nut	48	35	—
Output shaft-to-flange nut	131	97	—
Band adjustment screw	14	10	—
Pressure tap plug to case	14	10	—
Pump assembly-to-case screws	25	18	—
Reverse servo assembly-to-case screws (stage 1)	5	—	44
Reverse servo assembly-to-case screws (stage 2)	11	8	—
Separator to main control screws	7	—	62
Shift cable bracket screws	28	21	—
Solenoid body-to-case screws	8	—	71
Speed sensor-to-case screws	14	10	—
Torque converter adapter plate nuts to converter	40	30	—
Torque converter adapter plate-to-flexplate nut	40	30	—
Transmission cooler tube fitting to case	47	35	—
Transmission cooler tube nut to case fitting	40	30	—
Transmission fluid filter-to-case screws	10	—	89
Transmission fluid pan-to-case screws	11	8	—
Transmission insulator-to-extension housing center screw	48	35	—
Transmission mount-to-crossmember screws	63	46	—
Transmission crossmember-to-floor pan screws	55	41	—
Transmission-to-engine screws	48	35	—
Vehicle harness-to-solenoid body screw	5	—	44

Transmission Description

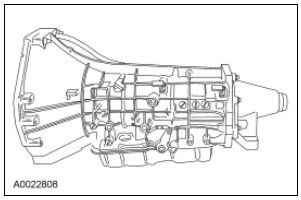
This transmission has:

- five forward speeds.
- electronic shift, pressure and Torque Converter Clutch (TCC) controls.
- three planetary gearsets.
- three bands.
- three multi-plate clutches.
- two One-Way Clutch (OWC).

All hydraulic functions are directed by electronic solenoids. The solenoids control:

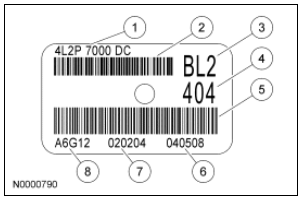
- static engagement feel.
- shift feel.
- shift scheduling.
- modulated TCC applications.
- engine braking utilizing the coast clutch and bands.
- manual first and second timing.
- reverse inhibit timing.

Transmission View



Identification Tags

Identification Tag Located on Transmission Case



Item	Description
1	Transmission part number
2	Bar code 1
3	Transmission plant model code part 1
4	Transmission plant model code part 2
5	Bar code 2
6	Transmission serial number
7	Transmission build date (DD MM YY)
8	Assembly plant line shift

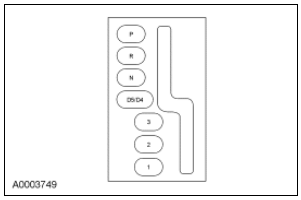
All vehicles come equipped with a Safety Compliance Certification Label. The location on the label marked TR is reserved for the transmission code. To determine the correct transmission for this vehicle, refer to the Owners's Literature, Transmission Code Designations. For transmission model, service identification level or build date information, refer to the transmission service identification tag located on the transmission case.

Range Selection

Depending on the vehicle options selected, the transmission range selector may have different range positions.

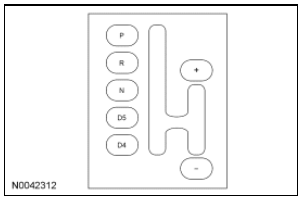
The standard range selector has eight positions: P, R, N, D5, 4, 3, 2 and 1.

Base Range Shifter



The optional select shift transmission (SST) range selector has seven positions P, R, N, D5, D4, + and -. This option will allow the driver to manually upshift and downshift into any gear range.

Optional Range Shifter



Park

In the PARK position:

- there is no power flow through the transmission.
- the parking pawl locks the output shaft to the case.
- the engine may be started.
- the ignition key may be removed.

Reverse

In the REVERSE position:

- the vehicle may be operated in a rearward direction, at a reduced gear ratio.
- backup lamps are illuminated.

Neutral

In the NEUTRAL position:

- there is no power flow through the transmission.
- the output shaft is not held and is free to turn.
- the engine may be started.

D5 (Overdrive)

D5 (overdrive) is the normal position for most forward driving.

The D5 (overdrive) position provides:

- automatic shift 1-5 and 5-1.
- apply and release of the torque converter clutch.
- maximum fuel economy during normal operation.
- engine braking in 5th gear.

D4 (Overdrive Canceled)

This position provides:

- automatic shift 1-4 and 4-1.
- apply and release of the torque converter clutch.
- engine braking in 4th gear.

Position 3 — 3rd Gear (Base Shifter)

This position provides:

- third gear start and hold.
- the torque converter clutch may apply and release.
- improved traction on slippery roads.
- engine braking.

Position 2 — 2nd Gear (Base Shifter)

This position provides:

- second gear start and hold.
- the torque converter clutch may apply and release.
- improved traction on slippery roads.
- engine braking.

Position 1 — 1st Gear (Base Shifter)

If position 1 is selected at normal road speeds, the transmission will downshift into the next lower gear and continue downshifting until the vehicle reaches 1st gear.

This position provides:

- first gear operation only.
- engine braking for descending steep grades.

+ and - Position Operation (Optional Shifter)

These positions allow the driver to manually select the appropriate upshift (+) or downshift (-) and gear range.

- Can only be entered from the D5 position.
- Gear ranges 1-5 provide the same function and ratio as found in the D5 or D4 automatic mode positions.
- Transmission will not upshift or downshift unless the selector lever is moved forward or rearward.
- One tap forward (+) will command the transmission to upshift one gear range.

- One tap rearward (-) will command the transmission to downshift one gear range.
- Upshifts are allowed at any vehicle speed, with the exception of 4th and 5th gear. The transmission will not do a 4th or 5th gear start. If 4th or 5th is selected with the vehicle stopped or moving slowly (around 15 mph or less), the transmission will shift back to 1st gear. If the vehicle is brought to a stop in 4th or 5th gear, the transmission will downshift to 1st gear.
- When downshifting at normal road speeds, the transmission will only allow a downshift into the next lower gear.
- If the shifter (-) is tapped more than once in rapid succession, the transmission will downshift only into the next lower gear. Then when the vehicle reaches a speed below a calibrated entry speed, the transmission will allow a downshift into the next lower gear, if again selected by the driver. This is to prevent engine and transmission damage and to keep the engine and transmission within allowable rpm ranges.
- An electronic indicator on the instrument cluster will display the selected gear.

Park Sense Switch

The park sense switch prevents the redundant PRNDL from displaying "P" until the shifter is in the PARK position.

Electronic Transmission Error Indicator

The vehicle is equipped with a redundant electronic gearshift indicator. This character appears with the key in the run position and displays the same gear selection as shown on the range selector floor console next to the range selector lever. If an "E" character flashes or remains on, this indicates a transmission malfunction.

Shift Patterns

Upshifts

Transmission upshifting is controlled by the PCM. The PCM receives inputs from various engine or vehicle sensors and driver demands to control shift scheduling, shift feel and Torque Converter Clutch (TCC) operation.

The PCM has an adaptive learn strategy to electronically control the transmission which will automatically adjust the shift feel. When the battery has been disconnected or a new battery installed, certain transmission operating parameters may be lost. The PCM must relearn these parameters. During this learning process you may experience slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Downshifts

Under certain conditions the transmission will downshift automatically to a lower gear range (without moving the transmission selector lever). There are 3 categories of automatic downshifts: coastdown, torque demand and forced (or kickdown) shifts.

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. If applied, the transmission will disengage the TCC to provide added acceleration.

Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size and engine and transmission calibration requirements.

Torque Converter

The torque converter transmits and multiplies torque. The torque converter is a 4-element device:

- Impeller assembly
- Turbine and damper assembly
- Reactor assembly
- Clutch

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller sets the fluid in motion.
- The turbine reacts to the fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects fluid going back into the impeller, allowing for torque multiplication.
- The clutch and damper assembly dampens powertrain torsional vibration and provides a direct mechanical connection for improved efficiency.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.

Geartrain

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Bands and clutches are used to hold and drive certain combinations of gearsets. This results in 5 forward ratios and 1 reverse ratio, which are transmitted to the output shaft and differential.

Gear Ratio	
1st	3.22 to 1
2nd	2.29 to 1
3rd	1.55 to 1
4th	1.00 to 1
5th	0.71 to 1
Reverse	3.07 to 1

Planetary Gearset — Overdrive (O/D)

For component location, refer to Transmission in this section.

The planetary gear Overdrive (O/D) carrier is driven by the input shaft.

- The O/D planetary gearset carrier drives the center shaft via the O/D One-Way Clutch (OWC) in 1st, 3rd, 4th and REVERSE gears.
- In 2nd and 5th gears, the O/D sun gear is held causing the pinion gears to rotate around the O/D sun gear.
- The pinion gears, in turn, drive the O/D ring gear resulting in the 5th (O/D) gear ratio.
- The O/D planetary gearset is internally splined to the coast clutch for engine braking.

Planetary Gearset — Forward

For component location, refer to Transmission in this section.

The forward planetary gearset is splined to the output shaft.

- The forward planetary gearset is driven by the forward ring gear when the forward clutch is applied.
- The forward planetary gearset pinions drive the forward sun gear.
- The forward sun gear is splined to the input shell.
- The forward carrier is splined to the output shaft.

Planetary Gearset — Low/Reverse

For component location, refer to Transmission in this section.

The low/reverse planetary gearset is connected to the reverse brake drum by lugs from the low/reverse brake

drum to the lugs of the low/reverse planetary gearset.

- The low/reverse planetary gearset is driven by the forward sun gear which is splined to the input shell.
- The forward sun gear drives the pinions in the low/reverse planetary gearset.
- The pinions of the low/reverse planetary gearset drive the output shaft ring gear and output shaft hub which is splined to the output shaft.
- The low/reverse planetary gearset can be held by the low One-Way Clutch (OWC) in the low/reverse brake drum, or by the low/reverse band.

Input Shaft

For component location, refer to Transmission in this section.

- The radial positioning of the input shaft is controlled by 2 bushings in the stator support.
- Axial positioning of the input shaft is controlled by the splines in the converter turbine hub and the retaining ring in the Overdrive (O/D) planetary carrier.

Output Shaft

For component location, refer to Transmission in this section.

The output shaft is supported by a bearing in the case and by a bearing in the extension housing. End positioning is controlled by the parking gear and by the reverse ring gear hub and snap ring.

Apply Components

Band — Overdrive (O/D)

For component location, refer to Transmission in this section.

During 2nd and 5th gear operation, hydraulic pressure is applied to the Overdrive (O/D) servo.

- This pressure causes the piston to move and apply force to the band.
- This action causes the O/D band to hold the O/D drum.
- This causes the O/D sun gear to be held stationary through the adapter plate and the O/D drum.

Band — Low/Reverse

For component location, refer to Transmission in this section.

During 2nd gear, 1st gear and REVERSE operation, hydraulic pressure is applied to the low/reverse servo.

- This pressure causes the servo to move and apply force to the low/reverse band.
- This action causes the low/reverse brake drum to be held.
- This action causes the low/reverse planetary assembly to be held stationary.

Band — Intermediate

For component location, refer to Transmission in this section.

During 3rd gear operation, hydraulic pressure is applied to the intermediate servo.

- This pressure causes the servo to move and apply force to the intermediate band.
- This action causes the direct clutch drum to be held.
- The intermediate band holds the intermediate brake and direct clutch drum to the case in 3rd gear.
- This causes the input shell and forward sun gear to be held stationary.

Clutches — Direct

For component location, refer to Transmission in this section.

The direct clutch is a multi-disc clutch made up of steel and friction plates.

- The direct clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- It is housed in the direct clutch drum.
- During 4th, 5th and REVERSE gear application, the direct clutch is applied transferring torque from the forward clutch cylinder to the direct clutch drum.
- This action causes the forward sun gear to drive the pinions of the low/reverse planetary carrier.

Clutches — Forward

For component location, refer to Transmission in this section.

The forward clutch is a multi-disc clutch made up of steel and friction plates.

- The forward clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- The forward clutch is applied in all forward gears.
- When applied, the forward clutch provides a direct mechanical coupling between the center shaft and the forward ring gear and hub.

Clutches — Coast

For component location, refer to Transmission in this section.

The coast clutch is a multi-disc clutch made up of steel and friction plates.

- The coast clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- The coast clutch is housed in the Overdrive (O/D) drum.
- The coast clutch is applied when in manual 1st and 3rd, 4th with (D) cancelled and REVERSE positions.
- When applied, the coast clutch locks the O/D sun gear to the O/D planetary carrier, thus preventing the One-Way Clutch (OWC) from overrunning when the vehicle is coasting.
    - ♦ This allows engine compression to help slow the vehicle and provide engine braking.

One-Way Clutch (OWC) — Direct

For component location, refer to Transmission in this section.

The direct OWC is a sprag-type OWC that is pressed into the center shaft.

- The direct OWC is driven by the ring gear of the O/D planetary carrier.
- The direct OWC holds and drives the outer splines of the center shaft in 1st, 3rd, 4th and REVERSE gears.
- The direct OWC overruns during all coast operations and at all times in 2nd and 5th gear.

One-Way Clutch (OWC) — Low/Reverse

For component location, refer to Transmission in this section.

The low/reverse OWC is a sprag-type OWC .

- The low/reverse OWC holds the low/reverse drum and low/reverse planetary assembly to the case in 1st and 2nd gear.
- In all other gears the low/reverse OWC overruns.

One-Way Clutch (OWC) — Overdrive (O/D)

For component location, refer to Transmission in this section.

The O/D OWC is a sprag-type OWC that connects the input shaft to the center shaft during drive operation.

The O/D OWC transmits torque in REVERSE, 1st, 3rd and 4th gears, as well as in manual 1st, manual 3rd and manual 4th gears.

- The input shaft connects through the O/D planetary carrier to the inner race.
- The outer race is part of the center shaft.
- The inner race contacts the assembly of sprags, and wedges them between the inner and outer races.
- The wedging action causes the input shaft and center shaft to be connected.

Hydraulic System

Transmission Fluid Pump

For component location, refer to Transmission in this section.

- The transmission fluid pump provides the transmission fluid pressure necessary to charge the torque converter, main control assembly, transmission cooling system, lubrication system and apply devices.
- The transmission fluid pump is a positive displacement, gear type pump.
    - The transmission fluid pump is driven by the torque converter impeller hub.

Filter

For component location, refer to Transmission in this section.

- All transmission fluid drawn from the transmission fluid pan by the transmission fluid pump passes through the transmission fluid filter.
- The transmission fluid filter and its accompanying seals are part of the transmission fluid path from the sump (pan) to the transmission fluid pump.
    - The transmission fluid filter has a bypass section which allows transmission fluid vented at the main regulator valve to be recirculated to the transmission fluid pump, without passing through the transmission fluid filter.

Main Control

For component location, refer to Transmission in this section.

- The main control assembly and related components are part of the pressure side of the hydraulic system.
- The main control assembly consists of the solenoids, the valve body assembly and the separator plate.
- These components combine to convert electrical signals into hydraulic actions.
    - All valves in the main control assembly are an iodized aluminum and cannot be sanded, filed or dressed in any other way. If there is any damage to the valves that prevents or restricts their movement, install a new main control assembly.

Transmission Electronic Control System

Electronic System Description

The PCM and its input/output network control the following transmission operations:

- Shift timing
- Line pressure (shift feel)
- Torque converter clutch (TCC)

The transmission control strategy combined with the engine control provides optimum powertrain operation under all conditions. When determining the best operating strategy for transmission operation, the PCM uses input information from certain engine-related and driver-demand related sensors and switches.

In addition, the PCM receives input signals from certain transmission-related sensors and switches. The PCM also uses these signals when determining transmission operating strategy.

Using all of these input signals, the PCM can determine when the time and conditions are right for a shift, or when to apply or release the torque converter clutch. It will also determine the pressure needed to optimize shift feel. To accomplish this, the PCM uses 3 pressure controls, 1 torque converter clutch and 4 shift solenoids to control transmission operation.

The following provides a brief description of each of the sensors and actuators used to control transmission operation.

Powertrain Control Module (PCM)

The operation of the transmission is controlled by the PCM. Many input sensors provide information to the PCM. The PCM then controls the actuators which determine transmission operation.

Air Conditioning (A/C) Clutch

An electromagnetic clutch is energized when the clutch cycling pressure switch closes. The switch is located on the suction accumulator/drier. The closing of the switch completes the circuit to the clutch and draws it into engagement with the compressor driveshaft. When the A/C is engaged, operating pressures are adjusted to compensate for additional load on the engine.

Brake Pedal Position (BPP) Switch

The brake pedal position (BPP) switch tells the PCM when the brakes are applied. The torque converter clutch disengages when the brakes are applied. The BPP switch closes when the brakes are applied and opens when they are released. The BPP is also used to disengage the brake shift interlock.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor detects engine coolant temperature and supplies the information to the PCM. The ECT sensor is used to control TCC operation.

Electronic Ignition (EI) System

The electronic ignition (EI) system consists of a crankshaft position sensor, a pair of 4-tower ignition coils and the powertrain control module. The ignition control module operates by sending crankshaft position information from the crankshaft position sensor to the ignition control module. The ignition control module generates a profile ignition pickup (PIP) signal (engine rpm) and sends it to the PCM. The PCM uses PIP signal in the transmission strategy, wide-open throttle (WOT) shift control, TCC control, and operating pressures.

Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor provides the sequential fuel injection (SFI) system mixture temperature information. The IAT sensor is used both as a density corrector for airflow calculation and to proportion cold enrichment fuel flow. The IAT sensor is installed in the air cleaner outlet tube. The IAT sensor is also used in determining control pressures.

Mass Air Flow (MAF) Sensor

The mass air flow (MAF) sensor measures the mass of air flowing into the engine. The MAF sensor output signal is used by the PCM to calculate injector pulse width. For transmission strategies, the MAF sensor is used to regulate electronic pressure control, shift and torque converter clutch scheduling.

Transmission Control (TC) Switch

The transmission control (TC) switch sends a signal to the PCM when the driver selects the D4 position, canceling operation of 5th (overdrive) gear.

The TC switch is located within the range selector assembly (base shifter only).

The PCM uses this signal to control the shift solenoids to disengage/disable 5th gear operation and activates coast clutch. At the same time, the PCM changes the instrument panel indicator to display D4.

When the driver moves the range selector lever back to the D5 position, 5th gear operation is enabled, the coast clutch is released and the instrument panel indicator changes to display D5.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer mounted on the throttle body. The TP sensor detects the position of the throttle plate and sends this information to the PCM. The TP sensor is used for shift scheduling, electronic pressure control (EPC) and TCC control.

Digital Transmission Range (TR) Sensor

The digital transmission range (TR) sensor is located on the outside of the transmission at the manual lever. The digital TR sensor completes the start circuit in PARK, NEUTRAL, and the back-up lamp circuit in REVERSE. The digital TR sensor also opens and closes a set of 4 switches that are monitored by the PCM to determine the position of the manual lever (P, R, N, D5, 3, 2, 1).

Turbine Shaft Speed (TSS) Sensor

The turbine shaft speed (TSS) sensor is a magnetic pickup that sends the PCM torque converter turbine speed information.

The TSS sensor is mounted externally on the case.

The PCM uses TSS information to help determine appropriate operating pressures and TCC operation.

Output Shaft Speed (OSS) Sensor

The output shaft speed (OSS) sensor is a magnetic pickup, located at the park gear, that sends a signal to the PCM to indicate transmission output shaft speed. The OSS sensor is mounted externally on the case. The OSS is used for torque converter clutch control, speed scheduling and to determine electronic pressure control.

Intermediate Shaft Speed Sensor

The intermediate shaft speed sensor is a magnetic pickup that sends planetary sun gear speed information to the PCM. The sensor is mounted externally on the center of the case.

The PCM uses the sensor information to aid in determining pressure requirements.

Pressure Control Solenoids (PCA, PCB, PCC)

The pressure control (PC) solenoids are a variable-force style (VFS) solenoid. The VFS-type solenoid is an electrohydraulic actuator combining a solenoid and a regulating valve.

The line pressure tap is used to verify output pressure from PC A or PC B by turning either one OFF, while verifying the output from the other solenoid. The second pressure tap is used to verify the output from the PC C solenoid.

There are 3 PC solenoids located in the solenoid body assembly used to control line pressure, band and clutch application pressure within the transmission.

The PCM varies the current to the PC solenoid.

The PCM has an adaptive learn strategy to electronically control the transmission which will automatically adjust the shift feel. When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The PCM must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Torque Converter Clutch (TCC) Solenoid

The TCC solenoid is a pulse width modulating-type solenoid that is used to control the apply and release of the TCC.

Shift Solenoids — (SSA, SSB, SSC, SSD)

Four ON/OFF shift solenoids allow the PCM to control shift scheduling.

- The solenoids are 3-way, normally closed style.
- The shift solenoids SSA, SSB, SSC and SSD provide gear selection of 1st through 5th and reverse gears by directing PC pressures to the appropriate elements.

Coast braking and manual gears are also controlled by the shift solenoids.

Transmission Fluid Temperature (TFT) Sensor

- The transmission fluid temperature (TFT) sensor is a thermistor-type sensor that varies a reference voltage signal. The resistance in the TFT sensor varies with temperature. The PCM monitors the voltage signal across the TFT sensor, and uses this information to determine the transmission fluid

temperature.
- The TFT sensor is located on the solenoid body.
- The PCM uses the TFT sensor signal to help determine shift scheduling, torque converter clutch operation and pressure control requirements.

It sends a voltage signal to the PCM. The voltage signal varies with transmission fluid temperature. The PCM uses this signal to determine whether a cold start shift schedule is necessary. The shift schedule is compensated when the transmission fluid temperature is cold. The PCM also inhibits TCC operation at low transmission fluid temperatures and determines PC solenoid operations.

Accelerator Pedal Position (APP) Sensor

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal. The APP sensor detects the position of the accelerator pedal and inputs this information as a voltage to the PCM. The PCM uses the APP sensor information to aid in determining shift scheduling, EPC and TCC.

Instrument Panel Range Selector Indicator

This indicator is an electronic readout in the instrument cluster which will match the position of the range selector (P, R, N, D5, D4, 3, 2, 1). If an error in the range selector assembly occurs, an "E" (error) will be displayed on the instrument panel.

Select Shift Transmission (SST) Switches (+ and -)

The positions indicated by a (+) or a (-) allow the driver to manually select the appropriate upshift (+) or downshift (-) and gear range.

The select shift transmission (SST) switches are located within the transmission range selector assembly and are momentary contact switches that send a signal to the PCM each time the driver moves the selector lever into the upshift or downshift gear range.

The PCM uses the input signals from the SST+ and the SST- switches, along with other vehicle inputs to determine which gear should be commanded.

Preliminary Inspection

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

The following items must be checked prior to beginning the diagnostic procedures:

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer concern or condition. Customer contact may be necessary in order to begin to verify the concern. Understand the condition as to when the concern occurs, for example:

- hot or cold vehicle temperature.
- hot or cold ambient temperature.
- vehicle driving conditions.
- vehicle loaded/unloaded.

After understanding when and how the concern occurs, proceed to verify the concern.

Verification of Condition

This section provides information that must be used in both determining the actual cause of customer concerns and executing the appropriate procedures.

The following procedures must be used when verifying customer concerns for the engine.

Determine Customer Concern

NOTE: Some transmission conditions can cause engine concerns. An Electronic Pressure Control (EPC) short circuit can cause engine misfire. The Torque Converter Clutch (TCC) not disengaging will stall the engine.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperatures
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshift

- Downshift
- Coasting
- Engagement
- Noise/vibration — check for dependencies, either rpm dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent or temperature dependent

Check Transmission Fluid Level and Condition

Transmission Fluid Level Check

NOTICE: **The vehicle should not be driven if the transmission fluid level is low or internal failure may result.**

NOTE: If the vehicle has been operated for an extended period of time at highway speeds, in city traffic, in hot weather or pulling a trailer, the transmission fluid must cool down 30 minutes to obtain an accurate reading.

This vehicle is not equipped with a transmission fluid level indicator. An incorrect level may affect the transmission operation and can result in transmission damage. To correctly check and add transmission fluid to the transmission, refer to Transmission Fluid Level Check in this section.

High Transmission Fluid Level

A transmission fluid level that is too high can cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid from the vent tube and possible transmission damage. If an overfill reading is indicated, refer to Transmission Fluid Level Check in this section.

Low Transmission Fluid Level

A low transmission fluid level can result in poor transmission engagement, slipping or damage. It can also indicate a leak in one of the transmission seals or gaskets.

Adding Transmission Fluid

NOTICE: **The use of any type of transmission fluid other than specified may result in transmission damage.**

If transmission fluid must be added, add transmission fluid in 0.25L (0.5 pt) increments through the transmission fluid pan level check screw opening. Do not overfill the transmission fluid, refer to Transmission Fluid Level Check in this section. For transmission fluid type, refer to the General Specification chart in this section.

Transmission Fluid Condition Check

1. Observe the color and the odor of the transmission fluid. Under normal circumstances, the color should be dark reddish, not brown or black.

2. Allow the transmission fluid to drip onto a facial tissue and examine the stain.

3. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.

4. If fluid contamination or transmission failure is confirmed by the sediment in the bottom of the transmission fluid pan, the transmission must be disassembled and completely cleaned.

5. Carry out diagnostic checks and adjustments. Refer to Diagnosis By Symptom in this section.

Water in Transmission Fluid

To correctly repair an automatic transmission or transaxle that has had water or coolant introduced into the system, completely disassemble, clean and replace the following parts:

- All internal and external seals
- All friction material; clutches and bands
- Torque converter
- All parts with bonded seals
- All solenoids
- All transmission fluid filters

Prior to installing the transmission or transaxle, the transmission fluid cooler(s), transmission fluid cooler tubes and transmission fluid cooler hoses need to be flushed and cleaned.

Road Testing Vehicle

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws, do not exceed posted limits.

NOTE: When the battery has been disconnected or a new battery is installed, certain transmission operating parameters may be lost. The PCM must relearn these parameters. During this learning process you may experience slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

The Shift Point Road Test and Torque Converter Operation Test provide diagnostic information on transmission shift controls and torque converter operation.

Shift Point Road Test

This test verifies that the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate the vehicle with the selector lever in the D5 position.
3. Apply minimum throttle and observe the speeds at which upshift occurs and the torque converter engages. Refer to the following Shift Speeds chart.
4. Stop the vehicle. Select the D4 position. Repeat Step 3. The transmission will make all upshifts except 4-5 and the torque converter clutch (TCC) should apply above 46 km/h (27 mph).
5. Press the accelerator pedal to the floor, wide open throttle (WOT). The transmission should shift from 3rd to 2nd, or 3rd to 1st, depending on vehicle speed, and the TCC should release.
6. With vehicle speed above 48 km/h (30 mph), move the transmission range selector lever from D4 position to manual 1 position and release the accelerator pedal. The transmission should immediately downshift to 3rd gear. When vehicle speed drops below 32 km/h (20 mph), the transmission should downshift into 1st gear.
7. If transmission fails to upshift/downshift or TCC does not apply/release, refer to Diagnosis By Symptom for possible causes.

Shift Speeds

Throttle Position	D5 Position Shift	Shift Speed Axle Ratio—All
Closed	5-4	35-42 km/h (22-26 mph)
	4-3	6-10 km/h (4-6 mph)
	3-2	6-10 km/h (4-6 mph)
	2-1	10-15 km/h (6-9 mph)
Minimum	1-2	13-16 km/h (8-10 mph)
Monitor PID:	2-3	21-26 km/h (13-16 mph)
TP volt 1.25	3-4	29-35 km/h (18-22 mph)
	4-5	40-45 km/h (25-28 mph)
Wide	1-2	64-74 km/h (40-46 mph)
Open	2-3	93-101 km/h (58-63 mph)
	3-4	140-148 km/h (87-92 mph)
	4-5	195-206 km/h (121-128 mph)

Torque Converter Diagnosis

Prior to installing a new torque converter, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of good torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new or remanufactured torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary Inspection.

2. Know and Understand the Customer Concern.

3. Verify the Concern — Carry out the Torque Converter Operation Test; refer to Torque Converter Operation Test in this section.

4. Carry out Diagnostic Procedures.

- Perform On-Board Diagnostic (OBD) test. Refer to Diagnostics in this section.
  - ♦ Repair all non-transmission related DTCs first.
  - ♦ Repair all transmission DTCs.
- Carry out the Line Pressure Test. Refer to Special Testing Procedures in this section.
- Carry out the Stall Speed Test. Refer to Special Testing Procedures in this section.
- Carry out the Diagnosis by Symptom Index. Refer to Diagnosis By Symptom in this section.
  - ♦ Use the index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed, diagnose and service as necessary before servicing the torque converter.

Torque Converter Operation Test

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws, do not exceed posted limits.

This test verifies that the Torque Converter Clutch (TCC) control system and the torque converter are operating correctly.

1. Check for DTCs. Refer to the Diagnostic Trouble Code (DTC) Charts in this section.

2. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in the (D) position.

3. After normal operating temperature is reached, maintain a constant vehicle speed of about 80 km/h (50 mph) and tap the brake pedal with the left foot.

4. The engine rpm should increase when the brake pedal is tapped, and decrease about 5 seconds after the pedal is released. If this does not occur, refer to Torque Converter Operation Concerns in Diagnosis By Symptom in this section.

5. If the engine stalls in the (D) or manual 2 at idle with the vehicle stopped, move the transmission selector lever to the manual 1 position. If the engine stalls, refer to Diagnosis By Symptom , Torque

Converter Operation Concerns in this section. Repair as necessary. If the engine does not stall in (D), refer to Diagnosis By Symptom in this section.

Visual Inspection

This inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
  - ♦ air conditioning.
  - ♦ generator (alternator).
  - ♦ engine turbo.
  - ♦ cellular telephone.
  - ♦ cruise control.
  - ♦ CB radio.
  - ♦ linear booster.
  - ♦ backup alarm signal.
  - ♦ computer.
- Vehicle modification:

These items, if not installed correctly, will affect the powertrain control module (PCM) or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size, or axle ratio changes.

- Leaks; refer to Leakage Inspection in this section.
- Correct linkage adjustments; refer to Section 307-05 .

Shift Linkage Check

Check for a misadjustment in shift linkage by matching the detents in the transmission range selector lever with those in the transmission. If they match, the misadjustment is in the indicator. Do not adjust the shift linkage.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted. Refer to Section 307-05 .

Check TSBs and OASIS

Refer to all Technical Service Bulletins (TSBs) and OASIS messages which pertain to the transmission concern and follow the procedure as outlined.

Carry Out On-Board Diagnostics (KOEO, KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Quick Test using a suitable diagnostic scan tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the powertrain control system.

Diagnostics

Special Tool(s)

ST1300-A	UV Leak Detector 164-R0756 or equivalent
ST1565-A	Pressure Gauge, Transmission Fluid 307-004 (T57L-77820-A)
ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
ST2538-A	Transmission Test Plate and Gasket 307-433-01, 307-433-02, 307-433-03
ST1137-A	73 III Automotive Meter 105-R0057 or equivalent
ST1761-A	Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1632-A	MLP-TR Cable 418-F107 (007-00111) or equivalent
ST1389-A	Transmission Tester 307-F016 (007-00130) or equivalent

Diagnosing electronically controlled automatic transmissions is simplified using the following procedures. It is important to remember that there is a definite procedure to follow. Do not take shortcuts or assume that critical checks or adjustments have already been made. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostics with Diagnostic Tool

NOTE: For detailed instruction and other diagnostic methods using the diagnostic tool, refer to the diagnostic tool tester and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

These quick tests should be used to diagnose the powertrain control module (PCM) and should be carried out in order.

- Quick Test 1.0 — Visual Inspection
- Quick Test 2.0 — Set Up
- Quick Test 3.0 — Key On, Engine Off
- Quick Test 4.0 — Continuous Memory
- Quick Test 5.0 — Key On, Engine Running
- Special Test Mode
    - ♦ Wiggle Test Mode
    - ♦ Output Test Mode
- PCM Reset Mode
- Clearing DTCs
- OBD II Drive Cycle

For further information on other diagnostic testing features using the WDS or generic diagnostic tool, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Output State Control (OSC) Mode

Output state control (OSC) mode allows the technician to take control of certain parameters to function the transmission.

For example, OSC allows the technician to shift the transmission only when commanding a gear change. If the technician commands 1st gear in OSC, the transmission will remain in 1st gear until the technician commands the next gear.

Another example of the OSC features is that a technician can command a shift solenoid to turn ON or OFF when carrying out an electrical circuit check. OSC has 2 modes of operation for transmission, the Bench Mode and the Drive Mode. Each mode/parameter has a unique set of vehicle operating requirements that the technician must meet before being allowed to operate OSC.

NOTE: To operate OSC, the digital transmission range (TR) sensor and the vehicle speed sensor (VSS) must be operational. No DTCs related to the digital TR sensor or the VSS can be present.

- The vehicle requirements MUST BE MET when SENDING the OSC value. Refer to vehicle requirements for each individual test.
- If the vehicle requirements are NOT MET when SENDING the OSC value, an ERROR MESSAGE will appear. When the ERROR MESSAGE is received, OSC is aborted and must be restarted.
- If after a sent value is substituted and the vehicle requirements are no longer met, the PCM will cancel the OSC value and resume normal operation. No error message will be sent.
- The OSC value XXX may be sent anytime to cancel OSC.

OSC Procedures

- Carry out visual inspection and vehicle preparation as necessary.
- Select "Vehicle and Engine Selection" menu.
- Select appropriate vehicle and engine.
- Select "Diagnostic Data Link."
- Select "Powertrain Control module."
- Select "Diagnostic Test Mode."
- Select "KOEO On-Demand Self Test and KOER On-Demand Self Tests."
- Carry out test and record DTCs.
- Repair all non-Transmission DTCs.
- Repair all VSS and digital TR sensor DTCs.
- Make sure that VSS and digital TR sensors are functional.
- Select "Active Command Modes."
- Select "Output State Control."
- Select "Trans - Bench Mode or Trans - Drive Mode."

OSC — Transmission Bench Modes

The following transmission Bench Modes may be used as necessary during diagnostics.

SSA, SSB, SSC, SSD and TCC in Bench Mode

⚠ CAUTION: The parking brake must be set prior to carrying out this procedure.

The Bench Mode allows the technician to carry out electrical circuit checks on the following components:

- SSA - Activates SS A OFF or ON.
- SSB - Activates SS B OFF or ON.
- SSC - Activates SS C OFF or ON.
- SSD - Activates SS D OFF or ON.
- TCC - Activates TCC OFF or ON.

OSC "SSA, SSB, SSC, SSD, TCC" Bench Mode operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever is in P or N.
- Key ON.
- Engine OFF.

OSC Command Values:

- OFF - Turns solenoid OFF.
- ON - Turns solenoid ON.
- XXX - Cancels OSC value sent.
- SEND - Sends the values to PCM.

Bench Mode Procedure for SSA, SSB, SSC, SSD and TCC

Follow operating instructions from the scan tool menu screen:

- Select "Output State Control."
- Select "Trans - Bench Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - SSA, SSB, SSC, SSD or TCC."
- Select "ON" to turn solenoid ON.
- Press "SEND" to send command ON.
- Select "OFF" to turn solenoid OFF.
- Press "SEND" to send command OFF.
- Select "XXX" to cancel at any time.
- Press "SEND."

PCA, PCB, PCC in Bench Mode

⚠ CAUTION: The parking brake must be set prior to carrying out this procedure.

The Bench Mode is also used to test the functionality of the transmission electronic pressure control. During Bench Mode, the PCx solenoids can be commanded in increments of 15 psi from 0 to 90 psi and 90 to 0 psi.

The line pressure tap is used to verify output pressure from PC A or PC B by turning either one OFF while verifying the output from the other solenoid. The second pressure tap is used to verify the output from the PC C solenoid.

The OSC functions for the parameter PCx allows the technician to choose the following options:

- PCx - Activates PCx to selected values.
- 00 - Sets PCx pressure to 00 psi.
- 15 - Sets PCx pressure to 15 psi.
- 30 - Sets PCx pressure to 30 psi.

- 45 - Sets PCx pressure to 45 psi.
- 60 - Sets PCx pressure to 60 psi.
- 75 - Sets PCx pressure to 75 psi.
- 90 - Sets PCx pressure to 90 psi.

OSC "PCx" Bench Mode should ONLY be operated to check PRESSURE FUNCTIONALITY using an installed pressure gauge (300 psi) when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever is in P or N.
- Pressure gauge installed.
- Key ON.
- Engine ON.
- Engine rpm at least 1500.

OSC "PCx" Bench Mode should ONLY be operated to complete PCx SOLENOID CIRCUIT PINPOINT TESTS when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs are present.
- Transmission range selector lever is in P or N.
- Key ON.
- Engine OFF.

OSC Command Values:

- 00 - Sets PCx pressure to 00 psi.
- 15 - Sets PCx pressure to 15 psi.
- 30 - Sets PCx pressure to 30 psi.
- 45 - Sets PCx pressure to 45 psi.
- 60 - Sets PCx pressure to 60 psi.
- 75 - Sets PCx pressure to 75 psi.
- 90 - Sets PCx pressure to 90 psi.
- XXX - Cancels OSC value sent.
- SEND - Sends the values to PCM.

Bench Mode Procedure for PCx

Following operating instructions from the scan tool menu screen:

- Select "Output State Control."
- Select "Trans - Bench Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - PCx."
- Select Value "0 - 90 psi."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

OSC — Transmission Drive Modes

The Drive Mode allows control of 3 transmission parameters. Each mode/parameter has a unique set of

vehicle operating requirements that the technician must meet before being allowed to operate OSC. The recommended procedure, when using the Drive Mode, is to control one parameter at a time.

The Drive Mode allows the technician to carry out the following functions on the transmission:

- GEAR - Allows upshifts or downshifts.
- TCC - Engages or disengages the torque converter clutch.
- FIRM_SFT - Commands a higher control pressure during upshift.

The pressure control (PCx) solenoids for this transmission are not directly controlled during Drive mode testing. Pressures may be raised during an upshift via the harsh shift control channel (FIRM_SFT).

GEAR in Drive Mode

This OSC function is used to test the transmission shift functions.

The OSC functions for the GEAR parameter allow the technician to choose the following options:

- 1 - PCM selects 1st gear.
- 2 - PCM selects 2nd gear.
- 3 - PCM selects 3rd gear.
- 4 - PCM selects 4th gear.
- 5 - PCM selects 5th gear.

OSC "GEAR" mode operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Engine ON.
- TCC OFF (TCC cannot be engaged).
- Transmission range selector lever in (D).
- Vehicle speed is greater than 3 km/h (2 mph).

OSC Command Values:

- 1 - PCM selects 1st gear.
- 2 - PCM selects 2nd gear.
- 3 - PCM selects 3rd gear.
- 4 - PCM selects 4th gear.
- 5 - PCM selects 5th gear.
- XXX - Cancels OSC value sent.
- SEND - Sends the values to the PCM.

Drive Mode Procedure for GEAR

Follow operating instructions from the scan tool menu screen.

- Select "Output State Control."
- Select "Trans - Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - GEAR."
- Select Value "1-5."
- Press "SEND" to send command.

- Reselect Value "1-5."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

TCC in Drive Mode

This OSC function is used to test whether the torque converter clutch (TCC) is engaging and disengaging correctly.

The OSC functions for the TCC parameter allows the technician to choose the following:

- TCC - Activates TCC OFF and ON.
- ON - Turns TCC solenoid ON.
- OFF - Turns TCC solenoid OFF.

OSC "TCC OFF" Drive Mode operates ONLY when:

- VSS and digital TR sensors are operational.
- No VSS and digital TR sensor DTCs present.
- Engine ON.
- Transmission range selector lever in (D).
- Vehicle speed is greater than 3 km/h (2 mph).

OSC "TCC ON" Drive Mode operates ONLY when:

- VSS and digital TR sensors are operational.
- No VSS and digital TR sensor DTCs present.
- Engine ON.
- Transmission range selector lever in (D).
- Vehicle speed is greater than 3 km/h (2 mph).
- Transmission in 2nd gear or higher.
- TFT is between 33-153°C (60-275°F).
- Brake not applied. "OFF" below 32 km/h (20 mph).
- Maintain steady speed.

OSC Command Values:

- OFF - Turns TCC OFF.
- ON - Turns TCC ON.
- XXX - Cancels OSC value sent.
- SEND - Sends the values to PCM.

Drive Mode Procedures for TCC

Follow operating instructions from the scan tool menu screen.

- Select "Output State Control."
- Select "Trans-Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - TCC."
- Select "ON" to turn solenoid ON.
- Press "SEND" to send command ON.

- Select "OFF" to turn solenoid OFF.
- Press "SEND" to send command OFF.
- Select "XXX" to cancel at any time.
- Press "SEND."

FIRM_SFT in Drive Mode

This OSC function is used to raise pressure during an upshift to determine whether the pressure control system is functioning correctly. Harsher shifts indicate that the pressure control system works at higher pressure. The best test for isolating pressure control system problems is to carry out the PCA, PCB, PCC in Bench Mode using a hydraulic pressure gauge.

The OSC functions for the parameter FIRM_SFT allows the technician to choose the following options:

- FIRM_SFT - Activates the harsh shift channel.
  - ♦ ON - Sets control pressure higher for all upshifts (determined by the PCM).
  - ♦ OFF - Sets control pressure to normal for all upshifts (determined by the PCM).
  - ♦ XXX - Cancels OSC for FIRM_SFT.

OSC "FIRM_SFT" Drive Mode operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever in O/D.
- Pressure gauge installed (optional).
- Key ON.
- Engine ON.
- Vehicle speed greater than 3 km/h (2 mph).
- TCC is OFF (TCC is not engaged).

OSC Command Values:

- ON - Sets control pressure high for all upshifts (determined by the PCM).
- OFF - Sets control pressure to normal for all upshifts (determined by the PCM).
- XXX - Cancel OSC for FIRM_SFT.
- SEND - Sends the values to the PCM.

DRIVE Mode procedure for FIRM_SFT

Follow operating instructions from the scan tool menu screen.

- Select "Output State Control".
- Select "Trans - Drive Mode".
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - FIRM_SFT."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

Using Output State Control (OSC) and Accessing PIDs

To confirm that the OSC value was sent by the scan tool and the PCM has accepted the OSC substitution, a corresponding PID for each OSC parameter must be monitored. Additional PIDs should be monitored to help

the technician adequately diagnose the transmission.

The following is a list of OSC parameters and their corresponding PID:

Corres-ponding PID	PID Description
BPP	Brake Pedal Position Switch On/Off
PCA	Pressure Control Solenoid A — Commanded Pressure
PCB	Pressure Control Solenoid B — Commanded Pressure
PCC	Pressure Control Solenoid C — Commanded Pressure
FIRMST	Firm Shift Control (FMC) Status Requested by OSC; 0 = FSC not Commanded by OSC, NGS PID Output = OFF; 1 = FSC Commanded by OSC, NGS PID Output = ON
GEAR	Commanded Transmission Gear (use in DRIVE only)
RPM	Engine Revolutions Per Minute
SSA	Shift Solenoid A Commanded ON
SSB	Shift Solenoid B Commanded ON
SSC	Shift Solenoid C Commanded ON
SSD	Shift Solenoid D Commanded ON
TCC	Torque Converter Commanded Duty Cycles (%)
TCCRAT	Torque Converter Speed Ratio (RPM and/or TSS)
TFT	Transmission Fluid Temperature (degrees Fahrenheit)
VSS	Vehicle Speed (mph)

To confirm that the OSC substitution occurred, SEND the OSC value and monitor the corresponding PID value. If no ERROR MESSAGE was received and the value of the corresponding PID is the same as the value sent from OSC, then the OSC substitution was successful.

Transmission Drive Cycle Test

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Drive Cycle Test must be followed exactly. Transmission failure must occur 4 times consecutively for shift error diagnostic trouble code (DTC) code to be set, and 5 times consecutively for continuous torque converter clutch (TCC) code to set.

NOTE: When carrying out the Transmission Drive Cycle Test, use the Solenoid Operation Chart for proper solenoid operation. Refer to Pinpoint Tests — OSC Equipped Vehicle in this section.

After carrying out the Quick Test, use the Transmission Drive Cycle Test for checking continuous codes.

1. Record and then erase Quick Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With transmission in (D) position, moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into 5th gear. Hold speed and throttle open steady for a minimum of 15 seconds.
5. With transmission in 5th gear and maintaining steady speed and throttle opening, lightly apply and release brake to operate stop lamps. Then hold speed and throttle steady for a minimum of 5 seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat steps 4 through 6 at least 5 times.
8. Carry out the Quick Test and record continuous DTCs.

After On-Board Diagnostics

NOTE: The vehicle wiring harness, powertrain control module (PCM) and non-transmission sensors may affect transmission operations. Repair these concerns first.

After the on-board diagnostic procedures are completed, repair all DTCs.

Begin with non-transmission related DTCs, then repair any transmission related DTCs. Refer to the Diagnostic Trouble Code (DTC) Charts in this section for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Make sure that the vehicle wiring harness and the PCM are diagnosed as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual will aid in diagnosing non-transmission electronic components.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the powertrain control module (PCM) wiring harness for correct connections, bent or broken pins, corrosion, loose wires, correct routing, correct seals and their condition. Check the PCM, sensors and actuators for damage. Refer to the Powertrain Control/Emissions

Diagnosis (PC/ED) manual.

NOTE: If a concern still exists after electrical diagnosis, refer to Diagnosis By Symptom in this section.

If DTCs appear while carrying out the on-board diagnostics, refer to the Diagnostic Trouble Code (DTC) Charts in this section for the appropriate repair procedure. Prior to entering pinpoint tests, refer to any TSBs and OASIS messages for transmission concerns.

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code Chart

**May also be generated by some other non-electric transmission hardware system.					
*Output circuit check, generated only by electrical symptoms.					
Five Digit DTC	**Component**	**Description**	**Condition**	**Symptom**	**Action**
P0102, P0103, P1100, P1101	Mass Air Flow (MAF) Sensor	MAF concerns	MAF system inoperative which may cause a transmission concern.	High/low electronic pressure control (EPC) pressure, incorrect shift schedule. Incorrect torque converter clutch engagement scheduling. Symptoms similar to a throttle position (TP) failure.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0112	Intake Air Temperature (IAT) Sensor	IAT indicates 125°C (254°F) (grounded)	Voltage drop across IAT exceeds scale set for temperature 125°C (254°F).	Incorrect EPC pressure. Either high or low which will result in harsh or soft shifts.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0113	IAT Sensor	IAT indicates -40°C (-40°F) (open circuit)	Voltage drop across IAT exceeds scale set for temperature -40°C (-40°F).	Incorrect EPC pressure. Either high or low which will result in harsh or soft shifts.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0114	IAT Sensor	IAT out of on-board diagnostic range	IAT temperature higher or lower than expected during key ON engine OFF (KOEO) and key ON engine running (KOER).	Rerun on-board diagnostic at normal operating temperature.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0117	Engine Coolant Temperature (ECT) Sensor	ECT indicates 125°C (254°F)	Voltage drop across ECT exceeds scale set for temperature 125°C (254°F) (grounded).	Torque converter clutch will always be off, resulting in reduced fuel economy.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0118	ECT Sensor	ECT indicates -40°C (-40°F)	Voltage drop across ECT exceeds scale set for temperature -40°C (-40°F)	Torque converter clutch will always be off, resulting in reduced fuel economy.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

			(open circuit).		
P0121, P0122, P0123, P1120, P1121, P1125, P1124	TP Sensor	TP concern	PCM has detected an error. This error may cause a transmission concern.	Harsh engagements, firm shift feel, abnormal shift schedule, torque converter clutch does not engage. Torque converter clutch cycling.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0121- P0124, P0221- P0224, P2100- P2107, P2110- P2112, P2121- P2124, P2126- P2129, P2121- P2135, P2138- P2140	Accelerator Pedal Position (APP) Sensor	APP concern	PCM has detected an error. This error may cause a transmission concern.	Harsh engagements, firm shift feel, abnormal shift schedule, torque converter clutch does not engage. Torque converter clutch cycling.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0300- P0308, P0320, P0340, P1351- P1364	Electronic Ignition (EI)	EI concerns	EI system is inoperative which may cause a transmission concern.	Harsh engagements and shifts, late wide open throttle (WOT) shifts, no torque converter clutch engagement.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0503, P0500, U1039	ABS	Insufficient vehicle speed sensor (VSS) input from ABS through the communication link	PCM detected a loss of vehicle speed signal through the communication link from ABS.	No transmission symptom. Instrument panel speedometer may be affected.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0705	Digital Transmission Range (TR) Sensor	Digital TR circuit failure	Digital TR circuits, indicating an invalid pattern in TR_D. Condition caused by a short	Harsh engagements, or wrong gear commanded. Defaults to (D) or invalid position.	GO to Pinpoint Test C.

			to ground or an open in TR4, TR3A, TR2 and/or TR1 circuits. This DTC cannot be set by an incorrectly adjusted digital TR sensor.	May turn malfunction indicator lamp (MIL) ON.	
P0708	Digital TR Sensor	Digital TR sensor circuit TR3A open	Digital TR sensor circuit TR3A reading 2.6v - 5.0v (open circuit). This DTC cannot be set by an incorrectly adjusted digital TR sensor.	Harsh engagements, or wrong gear commanded. Defaults to (D) or invalid position. May turn MIL ON.	GO to Pinpoint Test C.
P0711	Transmission Fluid Temperature (TFT) Sensor	No change in TFT	PCM has detected no TFT change during operation.	DTC is set. May flash transmission control indicator lamp (TCIL).	GO to Pinpoint Test B.
P0712	TFT Sensor	157°C (315°F) indicated TFT sensor circuit grounded	Voltage drop across TFT sensor exceeds scale set for temperature of 157°C (315°F).	DTC set. May flash TCIL.	GO to Pinpoint Test B.
P0713	TFT Sensor	-40°C (-40°F) indicated TFT sensor circuit open	Voltage drop across TFT sensor exceeds scale set for temperature -40°C (-40°F).	DTC set. May flash TCIL.	GO to Pinpoint Test B.
P0715	Turbine Shaft Speed (TSS) Sensor	Insufficient input from TSS sensor	PCM detected a loss of TSS signal during operation.	May turn on MIL.	GO to Pinpoint Test E.
P0717	TSS Sensor	TSS sensor signal intermittent	PCM has detected an intermittent TSS signal.	May flash TCIL.	GO to Pinpoint Test E.
P0718	TSS Sensor	TSS sensor signal noisy	PCM has detected a noisy TSS signal.	May flash TCIL.	GO to Pinpoint Test E.
P0720	Output Shaft Speed (OSS) Sensor	Insufficient input from OSS sensor	PCM detected a loss of OSS signal during operation.	Abnormal shift schedule, harsh shifts. May turn on MIL.	GO to Pinpoint Test E.
P0721	OSS Sensor	OSS sensor signal noisy	PCM has detected an erratic OSS signal.	Abnormal shift schedule, harsh shifts. May flash TCIL.	GO to Pinpoint Test E.
P0722	OSS Sensor	Insufficient input from OSS sensor	PCM detected a loss of OSS signal during operation.	Abnormal shift schedule, harsh shifts. May flash TCIL.	GO to Pinpoint Test E.
P0731**	Shift Solenoid A (SSA), Shift	1st gear ratio error	No 1st gear.	Correct gear ratio not achieved for	REFER to Diagnosis By Symptom in this

	Solenoid B (SSB), Shift Solenoid C (SSC) or Internal Parts			commanded gear. Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected. May flash TCIL.	section.
P0732**	SSA, SSB, SSC or Internal Parts	2nd gear ratio error	No 2nd gear.	Correct gear ratio not achieved for commanded gear. Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected. May flash TCIL.	REFER to Diagnosis By Symptom in this section.
P0733**	SSA, SSB, SSC or Internal Parts	3rd gear ratio error	No 3rd gear.	Correct gear ratio not achieved for commanded gear. Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected. May flash TCIL.	REFER to Diagnosis By Symptom in this section.
P0734**	SSA, SSB, SSC or Internal Parts	4th gear ratio error	No 4th gear.	Correct gear ratio not achieved for commanded gear. Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected. May flash TCIL.	REFER to Diagnosis By Symptom in this section.
P0735	SSA, SSB, SSC, Shift Solenoid D	5th gear ratio error	No 5th gear.	Correct gear ratio not achieved for commanded gear.	REFER to Diagnosis By Symptom in this section.

	(SSD) or Internal Parts			Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected. May flash TCIL.	
P0740*	Torque Convertor Clutch (TCC) Solenoid	TCC solenoid circuit failure during on-board diagnostic	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostics. May flash TCIL.	Open or short to battery power: harsh shifts or engagements, engine rpm higher than expected. Short to ground: vehicle stalls when in drive gear at idle, harsh shifts or engagements or engine rpm lower than expected. May turn on MIL.	GO to Pinpoint Test A.
P0741**	TCC Solenoid	TCC solenoid circuit error or stuck OFF	The PCM picked up an excessive amount of TCC slippage during normal vehicle operation.	TCC slippage/erratic or no TCC operation. Stuck OFF: harsh shifts or engagements. Engine RPM may be higher than expected. May flash TCIL.	GO to Pinpoint Test A.
P0743*	TCC Solenoid	TCC solenoid circuit failure during on-board diagnostics	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostics.	Open or short to battery power: harsh shifts or engagements, engine rpm higher than expected. Short to ground: vehicle stalls when in drive gear at idle, harsh shifts or engagements or engine rpm lower than expected. May turn on MIL.	GO to Pinpoint Test A.
P0745	Pressure Control A (PCA)	PCA solenoid or circuit fault	PCA functional fault — low pressure.	Incorrect shift pattern indicating mechanical or hydraulic failure of the transmission.	REFER to Diagnosis By Symptom in this section.

				May turn on MIL.	
P0748	PCA	PCA solenoid inoperative	Electrical failure of the solenoid detected.	Possible slip in gear and/or 3rd gear ratio. May turn on MIL.	GO to Pinpoint Test D.
P0750*	SSA	SSA solenoid circuit failure	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Open or short to battery power: 1st gear ratio incorrect or no gear ratio errors, no 1st gear. Short to ground: no 4th or 5th gear. May turn on MIL.	GO to Pinpoint Test A.
P0753*	SSA	SSA solenoid circuit failure	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Open or short to battery power: 1st gear ratio incorrect or no gear ratio errors, no 1st gear. Short to ground: no 4th or 5th gear. May turn on TCIL.	GO to Pinpoint Test A.
P0755*	SSB	SSB solenoid circuit failure	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Open or short to battery power: no 3rd gear. Short to ground: no 1st gear. May turn on MIL.	GO to Pinpoint Test A.
P0758*	SSB	SSB solenoid circuit failure	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Open or short to battery power: no 3rd gear. Short to ground: no 1st gear. May turn on MIL. May flash TCIL.	GO to Pinpoint Test A.
P0760*	SSC	SSC solenoid circuit failure	SSC circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Open or short to battery power: 2nd and 5th gear ratio incorrect. Short to ground: 1st gear ratio incorrect or no gear ratio errors. May turn on MIL.	GO to Pinpoint Test A.
P0763*	SSC	SSC solenoid circuit failure	SSC circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Open or short to battery power: 2nd and 5th gear ratio incorrect. Short to ground: 1st gear ratio incorrect or no gear ratio errors. May turn on TCIL.	GO to Pinpoint Test A.

P0765	SSD	SSD solenoid circuit failure	SSD circuit failed to provide voltage drop across solenoid. Circuit shorted to ground.	Short to ground: no engine braking. May turn on MIL.	GO to Pinpoint Test A .
P0768	SSD	SSD solenoid circuit failure	SSD circuit failed to provide voltage drop across solenoid. Circuit shorted to ground.	Short to ground: no engine braking in manual gears. May turn on TCIL.	GO to Pinpoint Test A .
P0775	Pressure Control B (PCB)	PCB solenoid or circuit fault	PCB functional fault — low pressure.	Incorrect shift pattern indicating mechanical or hydraulic failure of the transmission. Will turn on MIL.	REFER to Diagnosis By Symptom in this section.
P0778	PCB	PCB solenoid inoperative	Electrical failure of the solenoid detected.	No 2nd and 5th gear. Will turn on TCIL.	GO to Pinpoint Test D .
P0791	Intermediate Shaft Speed Sensor	Intermediate shaft speed sensor signal failure	PCM has detected a loss of the intermediate shaft speed sensor signal.	Harsh shifts. May flash TCIL.	GO to Pinpoint Test E .
P0794	Intermediate Shaft Speed Sensor	Intermediate shaft speed sensor signal intermittent	PCM has detected an intermittent intermediate shaft speed sensor signal.	Harsh shifts. May flash TCIL.	GO to Pinpoint Test E .
P0795	Pressure Control C (PCC)	PCC solenoid or circuit fault	PCC functional fault — low pressure.	Incorrect shift pattern indicating mechanical or hydraulic failure of the transmission. Will turn on MIL.	REFER to Diagnosis By Symptom in this section.
P0798	PCC	PCC solenoid inoperative	Electrical failure of the solenoid detected.	Incorrect gear ratio in 4th and 5th gear. Will turn on TCIL.	GO to Pinpoint Test D .
P0815	SST +/-	SST +/- circuit input signal failed	PCM has detected an incorrect voltage SST input.	May not be able to shift in SST manual mode.	REFER to Section 307-05 .
P0960	PCA	PCA solenoid circuit open	Voltage through PCA solenoid is checked. Error is noted if tolerance is exceeded.	Open circuit — causes maximum PCA pressure, harsh engagements and shifts. May flash TCIL.	GO to Pinpoint Test D .
P0962**	PCA	PCA solenoid circuit failure, short to ground	Voltage through PCA solenoid is checked. An error will be noted if tolerance is	Short circuit — causes minimum PCA pressure (minimum capacity) and limits engine	GO to Pinpoint Test D .

			exceeded.	torque (alternate firm). Slips in gear and 3rd gear incorrect. May turn on MIL.	
P0963	PCA	PCA solenoid short to battery power or short to ground	Voltage through PCA solenoid is checked. An error will be noted if tolerance is exceeded.	Short to power — causes maximum PCA pressure, harsh engagements and shifts. Short to ground — no 3rd gear. May flash TCIL.	GO to Pinpoint Test D.
P0964	PCB	PCB solenoid circuit open	Voltage through PCB solenoid is checked. Error is noted if tolerance is exceeded.	Open circuit — causes maximum PCB pressure, harsh engagements and shifts. May flash TCIL.	GO to Pinpoint Test D.
P0966	PCB	PCB solenoid circuit failure, short to ground	Voltage through PCB solenoid is checked. An error will be noted if tolerance is exceeded.	Short to ground — no 2nd and 5th gear. May turn on MIL.	GO to Pinpoint Test D.
P0967	PCB	PCB solenoid intermittent short to battery voltage, short to ground	Voltage through PCB solenoid is checked. An error will be noted if tolerance is exceeded.	Short to battery power: harsh shift and engagements. Short to ground — no 2nd and 5th gear. May flash TCIL.	GO to Pinpoint Test D.
P0968	PCC	PCC solenoid circuit open	Voltage through PCC solenoid is checked. Error is noted if tolerance is exceeded.	Open circuit — causes maximum PCC pressure, harsh engagements and shifts. May flash TCIL.	GO to Pinpoint Test D.
P0970	PCC	PCC solenoid circuit failure, short to ground	Voltage through PCC solenoid is checked. An error will be noted if tolerance is exceeded.	No 4th and 5th gear. May turn on MIL.	GO to Pinpoint Test D.
P0971	PCC	PCC solenoid intermittent short to power, short to ground	Voltage through PCC solenoid is checked. An error will be noted if tolerance is exceeded.	Short to battery power: harsh shift and engagements. Short to ground — no 4th or 5th gears. May flash TCIL.	GO to Pinpoint Test D.
P1116	ECT Sensor	ECT out of on-board diagnostic range	ECT temperature higher or lower than expected	Rerun on-board diagnostic at normal operating	REFER to the Powertrain Control/Emissions

			during KOEO and KOER.	temperature.	Diagnosis (PC/ED) manual.
P1124	TP	TP voltage high/low for on-board diagnostic	TP was not in the correct position for on-board diagnostic.	Rerun at appropriate TP per application.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1460	A/C	A/C clutch cycling pressure switch error	A/C or defrost ON condition may result from A/C clutch being ON during on-board diagnostic.	DTC set during on-board diagnostic — rerun with A/C OFF. Failed ON — EPC pressure slightly low with A/C OFF.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1501	VSS Input	VSS input high during self test	PCM had detected a VSS input signal during KOER self test.	Cannot run KOER.	Stop vehicle. Rerun KOER self-test. If KOER cannot be carried out, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1572	Brake Pedal Position (BPP) Switch	BPP switch circuit failed	Brake ON circuit failure during normal operation.	Failed ON or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed OFF or not connected — torque converter clutch will not disengage when brake is applied.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1636	SSx	SSx ISIG communication error	PCM has detected an error with the ISIG chip.	May turn on MIL.	INSTALL a new PCM.
P1700	Transmission	Transmission indeterminate failure	Internal component failure. Direct one-way clutch failure.	Failure mode effects management (FMEM) becomes active — engine rpm limited to 4,000 rpm. Failed a neutral condition in 1st, 3rd or 4th gear in automatic mode. Only 2nd and 5th gear available. Other DTCs that may set P1700: P0745, P1747, P1760, P1714, P1715, P0750, P0755.	If other solenoid DTCs are present, diagnose and repair them first. CLEAR DTCs and drive vehicle. If P1700 returns, disassemble transmission and inspect the direct one-way clutch. Repair as required. CLEAR DTC. Drive vehicle and verify repair.

P1702	Digital TR Sensor	Digital TR signal intermittent, code P0705, P0708 are set	See P0705, P0708 conditions.	See P0705, P0708 symptoms. May flash TCIL.	GO to Pinpoint Test C .
P1703	BPP Switch	Brake not actuated during on-board diagnostic KOER	Brake not cycled during KOER.	Failed ON or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed OFF or not connected — torque converter clutch will not disengage when brake is applied.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1703	BPP Switch	BPP switch circuit failed	Brake ON circuit failure during KOEO.	Failed ON or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed OFF or not connected — torque converter clutch will not disengage when brake is applied.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1704	Digital TR Sensor	Digital TR not in P or N during KOEO/KOER	Digital TR sensor or shift cable incorrectly adjusted or digital TR circuit failure.	DTC is set.	GO to Pinpoint Test C .
P1705	Digital TR Sensor	Digital TR not in P or N during KOEO/KOER	KOEO/KOER not run in P or N, or digital TR circuit failure.	DTC is set.	RERUN KOEO/KOER in P or N or GO to Pinpoint Test C .
P1711	TFT Sensor	TFT out of on-board diagnostic range	Transmission not at operating temperature during on-board diagnostic.	DTC set — vehicle cold or overheated.	Warm or cool vehicle to normal operating temperature. GO to Pinpoint Test B .
P1714	SSA	SSA inoperative	Mechanical failure of the solenoid detected.	Stuck OFF. Open or short to battery power: 1st gear ratio incorrect or no gear ratio errors, no 1st gear. May turn on MIL. Stuck ON. No 4th or 5th gear. May turn on MIL.	GO to Pinpoint Test F .
P1715	SSB	SSB inoperative	Mechanical failure of the solenoid detected.	Stuck OFF: 3rd gear ratio incorrect, no 3rd gear. Stuck ON: 1st gear ratio	GO to Pinpoint Test F .

				incorrect or no 1st gear. May turn on MIL.	
P1716	SSC	SSC inoperative	Mechanical failure of the solenoid detected.	Stuck OFF: 2nd and 5th gear ratio incorrect. Stuck ON: 1st gear ratio incorrect or no gear ratio errors. May turn on MIL.	GO to Pinpoint Test F.
P1717	SSD	SSD inoperative	Mechanical failure of the solenoid detected.	Stuck ON: no engine braking. May turn on MIL.	GO to Pinpoint Test F.
P1740**	TCC Solenoid	TCC solenoid inoperative	TCC not commanded. Mechanical failure of the solenoid detected.	Stuck OFF: harsh shifts or engagements, engine rpm higher than expected. Stuck ON: vehicle stalls when in drive gear at idle, harsh shifts or engagements or engine rpm lower than expected. May turn on MIL.	GO to Pinpoint Test F.
P1783	TFT Sensor	Transmission overtemp condition indicated	TFT exceeded 127°C (270°F).	Increase in control pressure. May flash TCIL.	GO to Pinpoint Test B.

Rotunda Transmission Tester

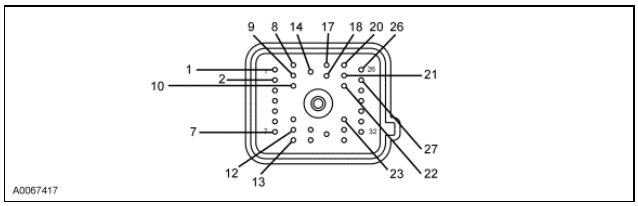
The Rotunda Transmission Tester is used to diagnose electronically controlled transmissions and is used in conjunction with the pinpoint tests. The tests should be carried out in order. Installing the Rotunda Transmission Tester allows separation of the vehicle electronics from transmission electronics. Refer to the Rotunda Transmission Tester manual for these tests.

- Digital Transmission Range (TR) Sensor Testing
- Resistance/Continuity Test
- Switch Test — Park/Neutral, Backup Lamp and Optional Circuits

Transmission Connector Layouts

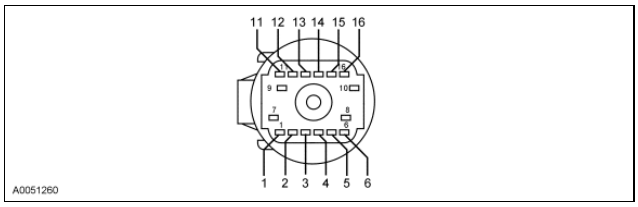
Connector Reference and Terminal Readings

Powertrain Control Module (PCM)



Pin Number	Circuit Description
1	Shift solenoid A (SSA)
2	Shift solenoid B (SSB)
7	Pressure control solenoid A (PC A)
8	Shift solenoid C (SSC)
9	Digital transmission range sensor TR3A to (PCM)
10	Digital transmission range sensor TR4 to (PCM)
12	Pressure control solenoid C (PC C)
13	Pressure control solenoid B (PC B)
14	Signal return
17	Shift solenoid D (SSD)
18	Digital transmission range sensor TR2 to (PCM)
20	Torque converter clutch (TCC) solenoid
21	Intermediate shaft speed sensor signal input
22	Digital transmission range sensor TR1 to (PCM)
23	Transmission fluid temperature (TFT) Sensor
26	Output shaft speed (OSS) sensor signal input
27	Turbine shaft speed (TSS) sensor signal input

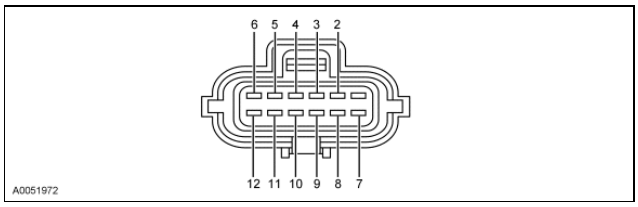
Transmission Vehicle Harness



Pin Number	Circuit Description
1	Pressure control (PCB) solenoid B
2	Transmission fluid temperature (TFT) sensor input

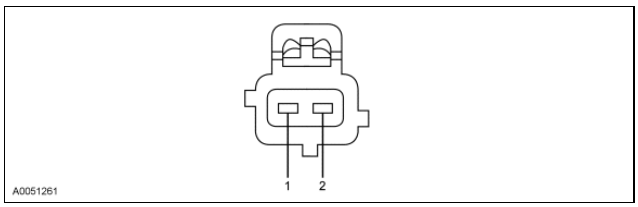
3	Solenoid power
4	Pressure control (PCC) solenoid C
5	Shift solenoid D (SSD)
6	Shift solenoid C (SSC)
11	Pressure control (PCA) solenoid A
12	Signal return
14	Torque converter clutch (TCC) solenoid
15	Shift solenoid B (SSB)
16	Shift solenoid A (SSA)

Digital Transmission Range (TR) Sensor



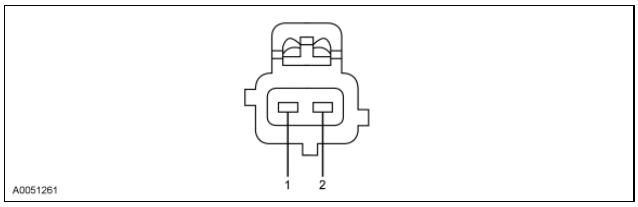
Pin Number	Circuit Description
2	Signal return
3	Digital transmission range (TR) sensor TR3A
4	Digital transmission range (TR) sensor TR1
5	Digital transmission range (TR) sensor TR2
6	Digital transmission range (TR) sensor TR4
7	Ground
8	Neutral switch sense input
9	Fused power feed
10	Starter solenoid central power
11	Reverse lamps
12	Starter relay (overload protected)

Turbine Shaft Speed (TSS) Sensor



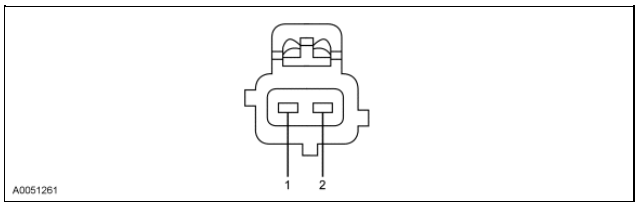
Pin Number	Circuit Description
1	Turbine shaft speed (TSS) sensor signal
2	Signal return

Output Shaft Speed (OSS) Sensor



Pin Number	Circuit Description
1	Output shaft speed (OSS) sensor signal
2	Signal return

Intermediate Shaft Speed Sensor Harness Connector



Pin Number	Circuit Description
1	Intermediate shaft speed sensor signal
2	Signal return

Digital Transmission Range (TR) Sensor Diagnosis Chart

Selector Position	Base Shift Lever Indicator	Select Shift Lever Indicator	PID: TR_D				PID: TR_V (volts)
			TR4	TR3A	TR2	TR1	TR3A (PCM pin 64 to signal return)
Park	P	P	0	0	0	0	0.0 volts
Reverse	R	R	1	1	0	0	1.3 - 1.8 volts
Neutral	N	N	0	1	1	0	1.3 - 1.8 volts
Overdrive	D5/D4	D5	1	1	1	1	1.3 - 1.8 volts
Manual 3	3	D4	1	0	1	0	0.0 volts
Manual 2	2	—	1	0	0	1	0.0 volts
Manual 1	Man 1	—	0	0	1	1	0.0 volts

A. TR_V is the voltage at the PCM pin 64 (TR3A Circuit) to signal return.
B. TR_D: 1= Open digital TR switch, 0= Closed digital TR switch.
C. EEC-V Control System Breakout Box Readings: Taken from PCM signal pins for TR1, TR2, TR3A and TR4 to signal return.
- **Voltages for TR1, TR2 and TR4:**
- 0 = 0.0 volts.
- 1 = 9.0 - 14.0 volts.

- **Voltage for TR3A:**
- 0 = 0.0 volts.
- 1 = 1.3 - 1.8 volts.

Wiggle Test Information for Open/Shorts

A. TR4, TR3A, TR2 and TR1 are all closed in PARK. PARK is a good position to check for intermittent open circuits (with scan tool monitoring TR_D).
B. TR4, TR3A, TR2 and TR1 are all open in OVERDRIVE, so OVERDRIVE is a good position to check for shorts to ground. To determine the shorted components while observing TR_D, unplug the TR and see if the short goes away. If the short is still present, unplug the transmission harness and see if the short goes away. If the short is still present, then the short is in the PCM or vehicle harness. Remove the suspect circuit(s) wire terminal from the PCM connector. If the short is still present, then the PCM has an internal failure; otherwise the failure is in the vehicle harness.

Pinpoint Tests — OSC Equipped Vehicle

Special Tool(s)

ST1565-A	Transmission Fluid Pressure Gauge 307-004 (T57L-77820-A)
ST1137-A	73 III Automotive Meter 105-R0057 or equivalent
ST1761-A	Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1632-A	MLP-TR Cable 418-F107 (007-00111) or equivalent
ST1389-A	Transmission Tester 307-F016 (007-00130) or equivalent

Shift Solenoid Pre-Diagnosis

Any time an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install new as necessary.

Use the following shift solenoid operation information when carrying out Pinpoint Test A.

Solenoid Operation Chart

Base Gearshift Selector Position	PCM Comm- anded Gear	5R55S Solenoid States						
		SSA	SSB	SSC	SSD	PCA	PCB	PCC
P	P	ON	OFF	OFF	ON	L	H/L	L
N	N	ON	OFF	OFF	ON	L	H/L	L
R	R	ON	OFF	OFF	ON	L/H	L	H
D5	1	ON	OFF	OFF	ON	H	H/L	L
	2	ON	OFF	ON	ON	L/H	H	L

	3	ON	ON	OFF	ON	H	L/H	L
	4	OFF	OFF	OFF	ON	H	H/L	H
	5	OFF	OFF	ON	ON	H	H	H
D4	1	ON	OFF	OFF	ON	H	H/L	L
	2	ON	OFF	ON	ON	L/H	H	L
	3	ON	ON	OFF	ON	H	L/H	L
	4	OFF	OFF	OFF	OFF	L/H	H	H
SST +/-	1	ON	OFF	OFF	ON	H	H/L	L
	2	ON	OFF	ON	ON	L/H	H	L
	3	ON	ON	OFF	ON	H	L/H	L
	4	OFF	OFF	OFF	ON	H	L/H	H
	5	OFF	OFF	ON	ON	H	H	H
Manual 3	3	ON	ON	OFF	OFF	H	L	H/L
Manual 2	2	ON	OFF	ON	OFF	H	L	H/L
Manual 1	1	ON	OFF	OFF	OFF	H	L	H/L

H = HIGH

L = LOW

H/L = PCM controlled

Manual = if equipped

Shift Solenoid Failure Mode Chart

Failed ON or OFF due to powertrain control module (PCM) and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON or OFF.

SSA, SSB

D5 Position	**Actual Gear**			
Gear	**SSA**		**SSB**	
	ON	**OFF**	**ON**	**OFF**
1	1	1	3	1
2	2	2	2	2
3	3	3	3	1
4	1	4	4	4
5	2	5	5	5
D4 Position				
1M	M1	M1	M3	M1
2M	M2	M2	1.1	M2
3M	M3	M3	M3	M1
4M	M1	M4	M4	M4

R	R	R	N	R

1.1 = Actual ratio with Forward Clutch, Intermediate and Overdrive Band applied.

SSC, SSD

D5 Position	**Actual Gear**			
Gear	**SSC**		**SSD**	
	ON	**OFF**	**ON**	**OFF**
1	2	1	1	1/M1
2	2	1	2	M2
3	3	3	3	3/M3
4	4/5	4	4	4/M4
5	5	4	5	5
D4 Position				
1M	M2	M1	1	M1
2M	M2	M1	2	M2
3M	1.1	M3	3	M3
4M	5	M4	4	M4
R	R	R	R	R

1.1 = Actual ratio with Forward Clutch, Intermediate and Overdrive Band applied.

PC A, PC B, PC C

D5 Posi- tion	**Actual Gear**					
Gear	**PC A**		**PC B**		**PC C**	
	L	**H**	**L**	**H**	**L**	**H**
1	1/S	1	1	1	1	1
2	2	2	1	2	2	2
3	1/S	3	3	3	3	3
4	4	4	4	4	1	4
5	5	5	4	5	2	5
D4 Position						
1M	1	M1	1	M1	M1	M1
2M	M2	M2	1	M2	M2	M2
3M	1	M3	3	M3	M3	M3
4M	M4	M4	4	M4	1	M4
R	R/S	R	R/S	R	R	R

H = High

L = Low

Slip = Slip due to low line pressure

1.1 = Actual ratio with Forward Clutch, Intermediate and Overdrive Band applied.

Pinpoint Tests

PINPOINT TEST A: SHIFT AND TORQUE CONVERTER CLUTCH SOLENOIDS

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

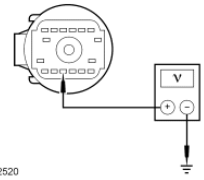
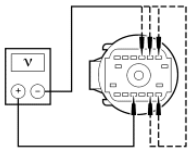
NOTE: Read and record all DTCs. All digital TR sensor and VSS DTCs must be repaired before entering output state control (OSC).

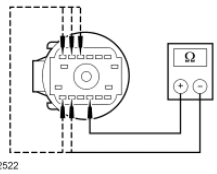
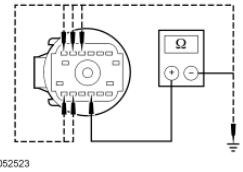
Test Step	Result / Action to Take
A1 ELECTRONIC DIAGNOSTICS	
• Ignition OFF. • Select PARK. • Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Diagnostic Data Link. • Enter the following diagnostic mode on the scan tool: PCM. • Enter the following diagnostic mode on the scan tool: Active Command Modes. • Enter the following diagnostic mode on the scan tool: Output State Control (OSC). • Enter the following diagnostic mode on the scan tool: Trans-Bench Mode. • **Does vehicle enter Trans-Bench Mode?**	**Yes** REMAIN in Trans-Bench Mode. GO to A2 . **No** REPEAT procedure to enter Trans-Bench Mode. If vehicle did not enter Trans-Bench Mode, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM or NGS.
A2 WIGGLE TEST	
• Remain in Trans-Bench Mode. • Select PIDs to be monitored. **PID Command** / **PID Actual** SSA / SSA	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to A3 .

SSB	SSB
SSC	SSC
SSD	SSD
TCC	TCC

- Select "ON" to turn suspect solenoid(s) on.
- Press "SEND."
- Wiggle all wiring and connectors to the transmission. Monitor the solenoid state for changes.
- Select "OFF" to turn solenoid(s) off.
- Press "SEND."
- Repeat steps for each solenoid.
- **Does the suspect solenoid(s) state change?**

A3 SOLENOID FUNCTIONAL CHECK	
• Monitor each solenoid state. • Turn each solenoid ON and OFF. • **Does the solenoid turn ON and OFF when commanded and can solenoid activation be heard?**	**Yes** GO to A4 . **No** GO to A5 .
A4 OSC TRANS-DRIVE MODE (GEAR OR TCC)	
• Carry out OSC Trans-Drive Mode. • Select GEAR for shift solenoids or follow procedures for GEAR as listed in this section. • Select TCC for torque converter clutch solenoid. Follow procedures of TCC in Drive Mode as listed in this section. • **Does the transmission upshift and downshift or torque converter engage/disengage when commanded?**	**Yes** CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom to diagnose shift or torque converter concern. **No** GO to A5 .
A5 CHECK FOR BATTERY VOLTAGE	
• Disconnect: Transmission Vehicle Harness Connector. • Visually inspect all wires and connectors for damage. • Ignition ON. • Measure the voltage on pin 3 harness side and ground.	**Yes** GO to A6 . **No** REPAIR the circuit. TEST for normal operation.

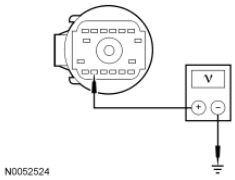
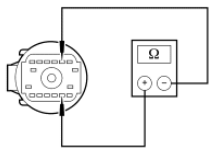
 N0052520 • **Is the voltage greater than 10 volts?**	
A6 ELECTRICAL SIGNAL CHECK	
• Leave positive lead connected to pin 3 and connect negative lead to pin 5, 6, 14, 15 and 16.  N0052521 • Enter the following diagnostic mode on the scan tool: Trans-Bench Mode. • Select parameter SSA, SSB, SSC, SSD or TCC. • Select "ON." • Press "SEND." • Measure the voltage while cycling the solenoids ON and OFF. • Select "OFF," press "SEND." • **Does the voltage change?**	**Yes** GO to A7 . **No** REPAIR the circuit. TEST the system for normal operation.
A7 CHECK SOLENOID RESISTANCE AT SOLENOID	
• Measure resistance between pin 3 and pin 5, 6, 14, 15 and 16 solenoid side. **Solenoid** / **Resistance (ohms)** SSA: 16-45 SSB: 16-45 SSC: 16-45 SSD: 16-45 TCC: 9-16	**Yes** GO to A8 . **No** INSTALL a new solenoid body assembly. TEST the system for normal operation.

 N0052522 • **Is the resistance within specification?**	
A8 CHECK SOLENOID FOR SHORT TO GROUND	
• Measure resistance between pin 3 and pin 5, 6, 14, 15 and 16 solenoid side and ground.  N0052523 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new solenoid body assembly. **No** REFER to Diagnosis By Symptom in this section for diagnosis of shift or torque converter concerns.

PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

Test Step	Result / Action to Take
B1 ELECTRONIC DIAGNOSTICS	
• Ignition OFF. • Select PARK. • Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding. • Connect the scan tool. • Ignition ON. • Select Diagnostic Data Link. • Select PCM. • Select PID/Data Monitor and Record. • Enter the following diagnostic mode on the scan tool: PIDs; TFT, TFTV. • **Does the vehicle enter PID/Data Monitor and Record?**	**Yes** REMAIN in PID/Data Control. GO to B2 . **No** REPEAT procedure to enter PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM and NGS.
B2 WARM-UP/COOL-DOWN CYCLE	
• While monitoring the TFT PIDs, carry out the following test: If transmission is cold, run transmission to warm it up. If transmission is warm, allow transmission to cool down.	**Yes** If the TFT PIDs increase as the transmission is warmed or decrease as the transmission is cooled, CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By

• **Do the TFT PIDs increase as the transmission is warmed up or decrease as the transmission is cooled or does the TFT or TFTV drop in and out of range?**	Symptom in this section to diagnose transmission overheating. If the TFT or TFTV drop in and out of range, INSPECT for intermittent concern in the internal/external harness, sensor or connector. **No** GO to B3 .
B3 ELECTRICAL SIGNAL CHECK	
• Disconnect: Transmission Harness Connector. • Visually inspect all wires and connectors for damage. • Measure voltage between pin 2 harness side and ground.  N0052524 • **Is the voltage between 4.5 and 5.0 volts?**	**Yes** GO to B4 . **No** REPAIR the circuit. TEST the system for normal operation.
B4 CHECK RESISTANCE OF TFT SENSOR	
• Measure resistance between pin 2 and 12 at solenoid body connector.  N0052525 • Record the resistance. • Resistance should be approximately in the following ranges: **Transmission Fluid Temperature** **°C** / **°F** / **Resistance (Ohms)** -40 to -20 / -40 to -4 / 967 K - 284 K -19 to -1 / -3 - 31 / 284 K - 100 K 0 - 20 / 32 - 68 / 100 K - 37 K	**Yes** REFER to Diagnosis By Symptom in this section to diagnose an overheating concern. **No** INSTALL a new solenoid body assembly.

21 - 40	69 - 104	37 K - 16 K
41 - 70	105 - 158	16 K - 5 K
71 - 90	159 - 194	5 K - 2.7 K
91 - 110	195 - 230	2.7 K - 1.5 K
111 - 130	231 - 266	1.5 K - 0.8 K
131 - 150	267 - 302	0.8 K - 0.54 K

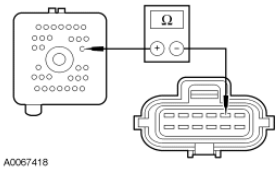
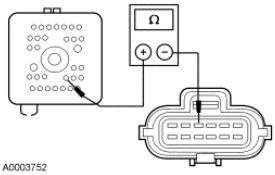
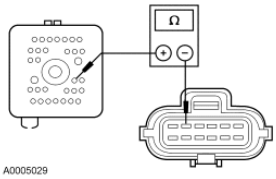
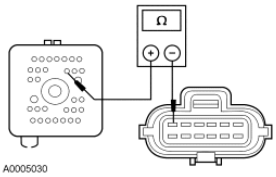
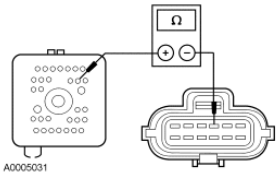
- **Is the resistance in the range?**

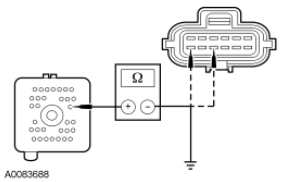
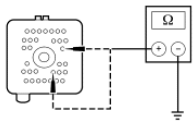
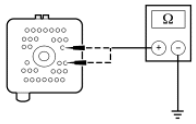
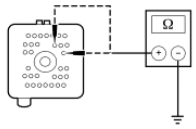
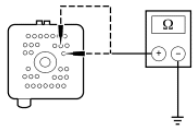
PINPOINT TEST C: DIGITAL TRANSMISSION RANGE (TR) SENSOR

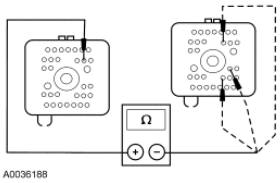
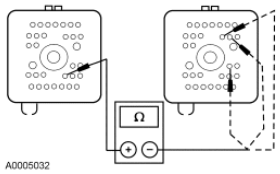
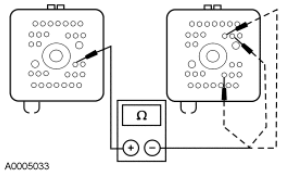
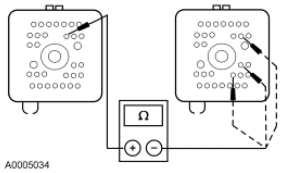
NOTE: Refer to the Digital Transmission Range (TR) Sensor Connector illustration and Digital Transmission Range (TR) Sensor Diagnosis Chart preceding these pinpoint tests.

Test Step	Result / Action to Take
C1 VERIFY DIAGNOSTIC TROUBLE CODES	
• Ignition OFF. • Select PARK. • Carry out on-board diagnostic test. • **Are only DTC codes P0705, P0708 present?**	**Yes** GO to C4 . **No** GO to C2 .
C2 VERIFY DIGITAL TRANSMISSION RANGE SENSOR ALIGNMENT	
• Ignition OFF. • Select PARK. • Check to make sure the digital TR sensor harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding. • Apply the parking brake. • Select NEUTRAL. • Disconnect the shift cable/linkage from the manual lever. • Verify that the TR Sensor Alignment Gauge fits in the appropriate slots. • **Is the digital TR sensor correctly adjusted?**	**Yes** GO to C3 . **No** ADJUST the digital TR sensor; REFER to Digital Transmission Range (TR) Sensor in this section. PLACE transmission range selector lever into PARK and CLEAR DTCs. RERUN OBD Tests. GO to C3 .
C3 VERIFY SHIFT CABLE/LINKAGE ADJUSTMENT	
• Place the range selector in D5. • Connect the shift cable/linkage. • Verify that the shift cable/linkage is correctly adjusted. REFER to Section 307-05 . • **Is the shift cable/linkage correctly adjusted?**	**Yes** GO to C4 . **No** ADJUST the shift cable/linkage. REFER to Section 307-05 .GO to C4 .
C4 CHECK ELECTRICAL SIGNAL OPERATION	
• Select PARK. • Disconnect: Digital TR Sensor. • ***NOTICE:*** **Do not pry on connector. This will damage the connector and result in a transmission concern.** • Inspect both ends of the connector for damage or pushed out pins, corrosion, loose wires and missing or damaged	**Yes** REPAIR as necessary. CLEAR DTCs and RERUN OBD Tests. **No** If diagnosing a DTC, GO to C5 .

seals. • **Is there damage to the connector, pins or harness?**	If diagnosing a starting concern or a backup lamp concern, GO to C10 .
C5 CHECK ELECTRICAL SYSTEM OPERATION (DIGITAL TR AND PCM)	
• Ignition OFF. • Connect the scan tool. • Connect: Digital TR Sensor. • Ignition ON. • Enter the following diagnostic mode on the scan tool: TR PIDS TR_D, TR_V. • Move transmission range selector lever into each gear and stop. • Observe the PIDs, TR_D, and TR_V (vehicle-dependent) while wiggling harness, tapping on sensor or driving the vehicle. Use PIDs TR_D for DTCs P0705, P1704 and P1705. Use PIDs TR_V for DTC P0708. • Compare the PIDs to the Digital Transmission Range (TR) Sensor Diagnosis Chart. • **Do the PIDs TR_D and TR_V match the Digital Transmission Range (TR) Sensor Diagnosis chart, and does the TR_D PID remain steady when the harness is wiggled, the sensor is tapped on, or the vehicle driven?**	**Yes** The problem is not in the digital TR sensor system. REFER to Diagnosis By Symptom in this section for further diagnosis. **No** If TR_D changes when wiggling harness, tapping on the sensor or driving the vehicle, the problem may be intermittent. GO to C6 .
C6 CHECK DIGITAL TRANSMISSION RANGE SENSOR OPERATION	
• Disconnect: Digital TR Sensor. • Connect: TR-E Cable to Transmission Tester. • Connect: TR-E Cable to Digital TR Sensor. • Place the DIGITAL TR Overlay onto Transmission Tester. • Carry out SENSOR Test as instructed on the digital TR Overlay. • **Does the status lamp on the tester TRS-E cable match the selected gear positions?**	**Yes** Concern is not in the digital TR sensor. GO to C7 . **No** INSTALL a new digital TR sensor and ADJUST. REFER to Digital Transmission Range (TR) Sensor in this section. CLEAR DTCs and RERUN OBD Tests.
C7 CHECK PCM HARNESS CIRCUITS FOR OPENS	
• Ignition OFF. • Disconnect: 150 Pin PTEC Module Connector "B". • Inspect for damaged or pushed out pins, corrosion or loose wires. • Disconnect: Digital TR Sensor. • ***NOTICE:*** **Do not pry the connector. This will damage the connector and result in a transmission concern.** • Measure resistance between TR pin 2 harness side and signal return PCM pin 14 harness side.	**Yes** GO to C8 . **No** REPAIR the circuits. TEST the system for normal operation.

 A0067418 • Measure resistance between PCM pin 22 and TR pin 4 harness side.  A0003752 • Measure resistance between PCM pin 18 and TR pin 5 harness side.  A0005029 • Measure resistance between PCM pin 10 and TR pin 6 harness side.  A0005030 • Measure resistance between PCM pin 9 and TR pin 3 harness side.  A0005031 • **Are the resistances less than 5 ohms?**	
C8 CHECK PCM HARNESS CIRCUITS FOR SHORT TO GROUND OR POWER	

• Measure resistance between PCM pin 14 and TR pins 10 and 12 harness side and ground.  A0083688 • Measure resistance between pin 22 harness side and ground; and pin 14 harness side and ground.  A0083701 • Measure resistance between pin 18 harness side and ground; and pin 14 harness side and ground.  A0083702 • Measure resistance between pin 10 harness side and ground; and pin 14 harness side and ground.  A0083703 • Measure resistance between pin 9 harness side and ground; and pin 14 harness side and ground.  A0083704 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to C9 . **No** REPAIR the circuits. TEST the system for normal operation. CLEAR DTCs. RERUN OBD Tests.

C9 CHECK FOR SHORT BETWEEN TR/PCM INPUT SIGNAL CIRCUITS	
• Measure resistance between pin 9 harness side and pin 22, pin 18 and pin 10 harness side.  A0036188 • Measure resistance between pin 22 harness side; and between pin 9, pin 18 and pin 10 harness side.  A0005032 • Measure resistance between pin 18 harness side; and between pin 22, pin 9 and pin 10 harness side.  A0005033 • Measure resistance between pin 10 harness side; and between pin 22, pin 18 and pin 9 harness side.  A0005034 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
C10 CHECK THE NON-PCM INTERNAL CIRCUITS OF SENSOR	
• Connect: TRS-E Cable to Transmission. • Connect: TRS-E Cable to Digital TR Sensor. • Place the Digital TR Overlay onto Transmission Tester. • Carry out Switch Test as instructed on the digital TR Overlay.	**Yes** Concern is not in the digital TR sensor. For backup lamp concerns, REFER to Section 417-01 . **No**

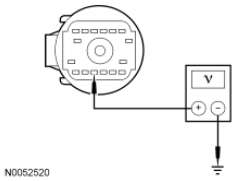
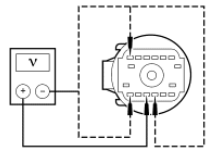
• **Does the status lamp on the tester indicate RED for the correct gear position?**	INSTALL a new digital TR sensor and ADJUST; REFER to Digital Transmission Range (TR) Sensor in this section. CLEAR DTCs and RERUN OBD Tests.

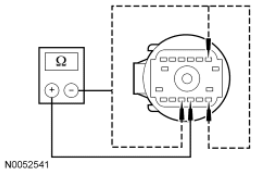
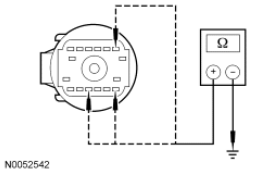
PINPOINT TEST D: PRESSURE CONTROL (PC) SOLENOIDS (PCA, PCB, PCC)

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

NOTE: Read and record all DTCs. All digital TR sensor and VSS DTCs must be repaired before entering output state control (OSC).

Test Step	Result / Action to Take
D1 ELECTRONIC DIAGNOSTICS	
• Ignition OFF. • Select PARK. • Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in the connector and in good condition before proceeding. • Install 300 psi pressure gauges into line and PC C tap. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Diagnostic Data Link. • Enter the following diagnostic mode on the scan tool: PCM. • Enter the following diagnostic mode on the scan tool: Active Command Modes. • Enter the following diagnostic mode on the scan tool: Output State Control (OSC). • Enter the following diagnostic mode on the scan tool: Trans-Bench Mode. • **Does the vehicle enter the Trans-Bench Mode?**	**Yes** REMAIN in Trans-Bench Mode. GO to D2 . **No** REPEAT procedure to enter Trans-Bench Mode. If vehicle did not enter OSC, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM or NGS.
D2 SOLENOID FUNCTIONAL TEST	
• Monitor pressure gauges. • Enter the following diagnostic mode on the scan tool: Parameter; PCx. • **NOTE:** Make sure that the solenoids not being tested are off or at zero. • Select PC A, PC B or PC C. • Select value - 15, 30, 45, 60, 70 or 90 psi. • Press "SEND." • Select another value "0-90 psi." • Press "SEND." • Enter the following diagnostic mode on the scan tool: XXX. • Press "SEND."	**Yes** CLEAR DTCs. **No** GO to D3 .

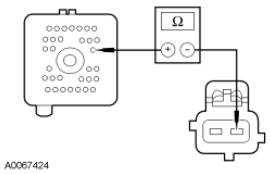
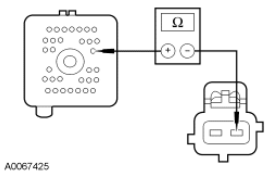
• **For PC A and PC B: Does the pressure reading for A or B follow the commanded pressure (actual A and B pressures will be higher than the commanded pressure)? For PC C: Does the pressure reading match the commanded pressure?**	
D3 CHECK FOR BATTERY VOLTAGE	
• Disconnect: Transmission Harness Connector. • Visually inspect all wires and connectors for damage. • Ignition ON. • Measure voltage between pin 3 harness side and ground.  N0052520 • **Is the voltage greater than 10 volts?**	**Yes** GO to D4 . **No** REPAIR the circuit. TEST the system for normal operation.
D4 ELECTRICAL SIGNAL CHECK	
• Leave positive lead connected to pin 3 and connect negative lead to pins 1, 4 and 11 harness side.  N0052540 • Activate solenoids (ON and OFF) while monitoring the voltage reading. • Enter the following diagnostic mode on the scan tool: Trans-Bench Mode. • Enter the following diagnostic mode on the scan tool: Parameter; PCx. • Select a value "0-90 psi." • Press "SEND." • Select another value "0-90 psi." • Press "SEND." • Enter the following diagnostic mode on the scan tool: XXX. • Press "SEND." • **Does the voltage and solenoid state change?**	**Yes** GO to D5 . **No** CHECK for open or short circuit in harness or PCM.
D5 CHECK SOLENOID RESISTANCE AT SOLENOID	

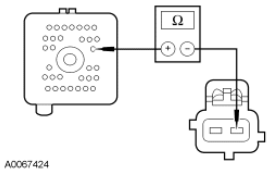
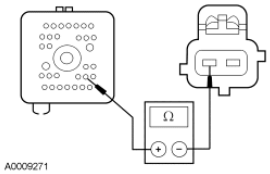
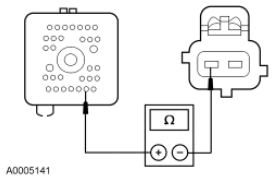
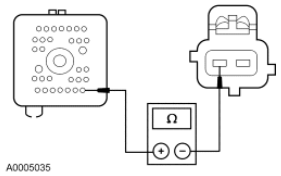
• Measure and record resistance between PC solenoid pin 3 and pins 1, 4 and 11. Resistance should be between 3.3 and 7.5 ohms.  N0052541 • **Is the resistance within specifications?**	**Yes** GO to D6 . **No** INSTALL a new solenoid body assembly.
D6 CHECK SOLENOID FOR SHORT TO GROUND	
• Measure and record resistance between PC solenoid pins 1, 4, 11 and ground solenoid side.  N0052542 • **Is the resistance less than 10,000 ohms?**	**Yes** INSTALL a new solenoid body assembly. TEST the system for normal operation. **No** REFER to Diagnosis By Symptom in this section for diagnosis of pressure concerns. TEST the system for normal operation.

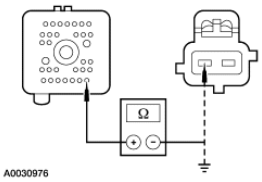
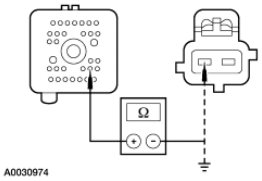
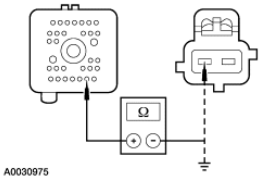
PINPOINT TEST E: TURBINE SHAFT SPEED (TSS), INTERMEDIATE SHAFT SPEED AND OUTPUT SHAFT SPEED (OSS) SENSORS

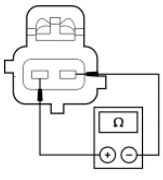
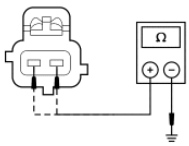
NOTE: Refer to the Turbine Shaft Speed (TSS), Intermediate Shaft Speed and Output Shaft Speed (OSS) Sensor Connector illustrations preceding these pinpoint tests.

Test Step	Result / Action to Take
E1 ELECTRONIC DIAGNOSTICS	
• Check to make sure the transmission harness connectors are fully seated, terminals are fully engaged in connector and in good condition before proceeding. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Diagnostic Data Link. • Enter the following diagnostic mode on the scan tool: PCM. • Select PID/Data Monitor and Record. • Select the following PIDs: TSS, intermediate shaft speed or OSS. • **Does vehicle enter PID/Data Monitor and Record?**	**Yes** REMAIN in PID/Data. GO to E2 . **No** REPEAT procedure to ENTER PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM or NGS.

E2 DRIVE CYCLE TEST	
• While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. • **Does the TSS, intermediate shaft speed or OSS speed PID increase and decrease with engine and vehicle speed?**	**Yes** GO to E3 . **No** If the TSS, intermediate shaft speed or OSS speed PID does not increase and decrease with engine and vehicle speed, INSPECT for open or short in vehicle harness, sensor, a PCM concern, or internal hardware concern. GO to E4 .
E3 DRIVE CYCLE TEST ERRATIC	
• While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. • **Is the TSS, intermediate shaft speed or OSS speed PID signal erratic (drop to zero or near zero and return to normal operation)?**	**Yes** If the sensor signal is erratic, INSPECT for intermittent concern in the harness, sensor, or connector. GO to E4 . **No** CLEAR all DTCs. RERUN OBD.
E4 CHECK PCM HARNESS CIRCUITS FOR OPENS	
• Ignition OFF. • Disconnect: 150 Pin PTEC Module Connector "B". • Inspect for damaged or pushed out pins, corrosion or loose wires. • For OSS, measure resistance between pin 14 and the appropriate sensor connector pin 2 harness side.  A0067424 • For intermediate shaft speed, measure resistance between pin 14 and the appropriate sensor connector pin 2 harness side.  A0067425	**Yes** GO to E5 . **No** REPAIR the circuit. TEST the system for normal operation.

• For TSS, measure resistance between pin 14 and appropriate sensor connector pin 2 harness side.  A0067424 • For intermediate shaft speed, measure resistance between pin 21 and appropriate sensor connector pin 1 harness side.  A0009271 • For TSS, measure resistance between pin 27 and appropriate sensor connector pin 1 harness side.  A0005141 • For OSS, measure resistance between pin 26 and appropriate sensor connector pin 1 harness side.  A0005035 • **Are all resistances less than 5 ohms?**	
E5 CHECK PCM HARNESS CIRCUITS FOR SHORT TO GROUND	

• For OSS, measure resistance between pin 26 and sensor connector pin 1 harness side and ground.  A0030976 • For intermediate shaft speed, measure resistance between PCM pin 21 and sensor connector pin 1 harness side and ground.  A0030974 • For TSS, measure resistance between PCM pin 27 and sensor connector pin 1 harness side and ground.  A0030975 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to E6 . **No** REPAIR the circuits. TEST the system for normal operation. CLEAR DTCs. RERUN OBD Tests.
E6 CHECK RESISTANCE OF TSS, INTERMEDIATE SHAFT SPEED or OSS SENSOR	
• Disconnect the appropriate vehicle harness connector from the TSS, intermediate shaft speed or OSS sensor. • Connect ohmmeter negative lead to one pin of the sensor and the positive lead to the other pin on the sensor.	**Yes** GO to E7 . **No** INSTALL a new sensor.

 A0005211 • Record the resistance. Resistance should be as follows: **Resistance** / **Temperature** 266-390 ohms / -20°C (4°F) 325-485 ohms / 21°C (70°F) 492-738 ohms / 150°C (302°F) • **Is the resistance within specification for the appropriate sensor?**	
E7 CHECK SENSORS FOR SHORT TO GROUND	
• Measure resistance between pin 1 and 2 of each sensor and ground.  A0005501 • **Is the resistance less than 10,000 ohms?**	**Yes** INSTALL a new sensor. **No** REFER to Diagnosis By Symptom for diagnosis of shift or torque converter concerns in this section.

PINPOINT TEST F: SOLENOID MECHANICAL FAILURE

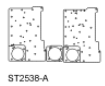
NOTE: Repair all other DTCs before repairing the following DTCs: P1714, P1715, P1716, P1717 and P1740.

Test Step	Result / Action to Take
F1 ELECTRONIC DIAGNOSIS	
• Connect the scan tool. • Select PARK. • Ignition ON. • Carry out KOEO test until continuous DTCs have been displayed. • If any of the following DTCs are present, continue with this test: P1714, P1715, P1716, P1717 and P1740. • **Are other DTCs present for TFT or shift solenoids?**	**Yes** REPAIR the DTCs for TFT or shift solenoids first. CLEAR DTCs and CARRY OUT transmission Drive Cycle Test. RERUN Quick Test. **No** INSTALL a new solenoid and/or body. REFER to the Diagnostic Trouble Code (DTC) Charts for code description. GO to F2 .

F2 TRANSMISSION DRIVE CYCLE TEST	
• Carry out transmission drive cycle test. Refer to Transmission Drive Cycle Test in this section. • **Does the vehicle upshift and downshift OK?**	**Yes** GO to F3 . **No** REFER to Diagnosis By Symptom in this section to diagnose shift concerns.
F3 RETRIEVE DTCS	
• Connect the scan tool. • Select PARK. • Ignition ON. • Carry out KOEO test until continuous DTCs have been displayed. • **Are DTCs P1714, P1715, P1716, P1717 and P1740 still present?**	**Yes** INSTALL a new PCM. ROAD TEST and RERUN Quick Test. **No** Testing completed. If a concern still exists, REFER to Diagnosis By Symptom in this section for concern diagnosis.

Special Testing Procedures

Special Tool(s)

 ST2538-A	Transmission Test Plate and Gasket 307-433-01, 307-433-02, 307-433-03
ST1565-A	Transmission Fluid Pressure Gauge 307-004 (T57L-77820-A)

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portion of the transmission.

Engine Idle Speed Check

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine idle speed.

Line Pressure Test

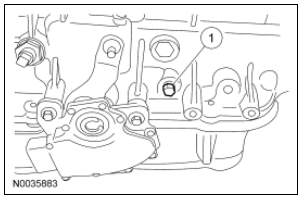
⚠ CAUTION: Carry out Line Pressure Test prior to carrying out Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or further transmission damage will occur. Do not maintain wide open throttle (WOT) in any gear range for more than 5 seconds.

NOTE: Certain sensor failures may cause high PC, FMEM (failure mode effect management) actions. Be sure that self-test and electrical repairs have been carried out, or test results may be incorrect.

NOTE: The line pressure tap is used to verify output pressure from PC A or PC B by turning either one OFF while verifying the output from the other solenoid. The second pressure tap is used to verify the output from the PC C solenoid.

This test verifies that the line pressure is within specifications.

1. Connect pressure gauge to the line pressure tap.



Item	Part Number	Description
1	—	Line pressure tap

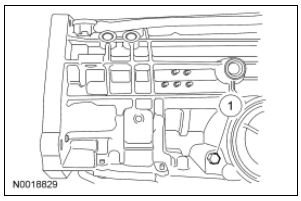
2. Start engine and check line pressures. Refer to the following Line Pressure Chart to determine if line pressure is within specifications.

Line Pressure Chart

Range	Idle Pressure		WOT Stall Pressure	
	PC C	Line	PC C	Line
P/N	1-103 kPa (0-15 psi)	862-1,137 kPa (125-165 psi)		
R	758-862 kPa (110-125 psi)	965-1,551 kPa (140-225 psi)	758-862 kPa (110-125 psi)	2,000-2,482 kPa (290-360 psi)
D5	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)
D4	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)
M5/M4	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)
M3	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)
M2/M1	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)

3. If line pressure is not within specifications, check PC C pressure.

4. Connect pressure gauge to PC C pressure tap.



Item	Part Number	Description
1	—	Pressure control (PC C) tap

5. Start engine and check PC C pressure. Refer to Line Pressure Diagnosis Chart in this section for specification.

6. If PC C pressure is not within specification, GO to Pinpoint Test D to diagnose PC C operation. If PC C operation is OK, refer to Line Pressure Diagnosis Chart in this section for line pressure concern causes.

Line Pressure Diagnosis Chart

Test Results	Possible Source
High at Idle — All Ranges	• Wiring harnesses • PC C boost valve • PC C solenoid • Main regulator valve

Low at Idle — All Ranges	• Low fluid level • Fluid inlet filter/seal • Main control body • CrosslLeaks • Gaskets • Pump • Separator plate
Low — All Forward Ranges	• Forward clutch • Main control • Overdrive servo • Intermediate servo
Low in Park Only	• Valve body
Low in Reverse Only	• Separator plate • Rear servo piston, cover seal • Reverse clutch • Overdrive servo • Intermediate servo • Valve body • Forward clutch
Low in Neutral Only	• Valve body • Overdrive servo • Intermediate servo
Low in D5 Only	• Forward clutch • Overdrive servo • Intermediate servo • Valve body
Low in D4 Only (O/D Cancelled)	• Forward clutch • Overdrive servo • Intermediate servo • Valve body
Low in 1st Position	• Forward clutch • Valve body
Low in 2nd Position	• Intermediate servo • Overdrive servo • Intermediate servo • Forward clutch
Low in 3rd Position	• Intermediate servo • Overdrive servo • Forward clutch

Stall Speed Test

This test checks operation of the following items:

- Torque converter clutch
- Forward clutch
- Low one-way clutch (OWC) assembly
- Engine operation
- Overdrive one-way clutch assembly

⚠ WARNING: Apply the parking brake firmly while carrying out each stall test.

⚠ CAUTION: Always carry out the Line Pressure Test procedures prior to carrying out the Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or further transmission damage will occur.

NOTE: The Stall Speed Test should be carried out with the engine and transmission at normal operating temperatures.

1. Connect tachometer to the engine.
2. **⚠ CAUTION: After testing each of the following ranges D5, D4, 3, 2, 1 and R, move the transmission range selector lever to N (NEUTRAL) and run the engine at 1,000 rpm for about 15 seconds to allow the torque converter to cool before testing the next range.**

   ⚠ CAUTION: Do not maintain wide open throttle (WOT) in any range for more than 5 seconds.

   ⚠ CAUTION: If the engine rpm recorded by the tachometer exceeds maximum specified rpm, release the accelerator pedal immediately. Clutch or band slippage is indicated.

   NOTE: Prolonged use of this procedure may set DTC P0712, P1783. After carrying out Stall Speed Test, run OBD Test and clear DTCs from memory.

   Press accelerator pedal to floor (WOT) in each range. Record rpm reached in each range. Stall speeds should be as follows:

Stall Speed Chart

Vehicle	Engine	RPM
Lincoln LS	3.9L	2,268-2,677

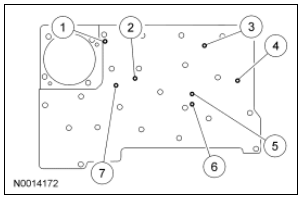
If stall speeds were too high, refer to the following Stall Speed Diagnosis Chart. If stall speeds were too low, first check the engine idle speed. If engine idle is OK, remove torque converter and check the torque converter one-way clutch for slippage.

Stall Speed Diagnosis Chart

Transmission Range Selector Lever Position	Stall Speeds High	Stall Speeds Low
D5, D4 and 1	Overdrive one-way clutch, rear one-way clutch	—
D4, 2 and 1	Forward clutch, overdrive one-way clutch	—
D5	Forward clutch, overdrive one-way clutch	—
D5, D4, 3, 2, 1 and R	General pressure concerns, forward clutch, overdrive one-way clutch	Converter one-way clutch or engine driveability concerns
R Only	High/reverse, high clutch, low and reverse band/servo	—

2 Only	Intermediate band/servo	—
1 Only	Low/reverse band/servo	—

Air Pressure Tests



Item	Part Number	Description
1	—	Reverse servo
2	—	Intermediate servo
3	—	Overdrive servo
4	—	Coast clutch
5	—	Forward clutch
6	—	Direct clutch
7	—	Reverse servo modulator

A no-drive or erratic shift condition may be due to inoperative bands and clutches. To diagnose these conditions, a series of checks can be made by substituting air pressure for fluid to determine the location of the damaged or obstructed component.

Follow the procedure to determine the location of the inoperative clutch or band by substituting air pressure into the various test plate passages.

NOTE: Use only dry, regulated 276 kPa (40 psi) maximum air pressure.

1. Remove the main control valve body. Refer to Main Control Valve Body in this section.

2. Install the transmission test plate and gasket.
   - Tighten to 10 Nm (89 lb-in).

3. **NOTE:** Do not apply air to the test plate vent hole.

   Apply air to the appropriate clutch or servo port (refer to plate layout diagram). Refer to the Air Pressure Test Diagnostic Chart for conditions, possible causes and actions.

4. After the testing is completed, remove the air test plate and basket and proceed with any repairs that are needed.

5. After the repairs are completed, install the main control valve body. Refer to Main Control Valve Body in this section.

Air Pressure Test Diagnostic Chart

Condition	Possible Causes	Actions

Dull thud heard or movement felt when air is applied and released	Clutches, bands and fluid passages are OK.	Concerns may not be in the transmission. Check the PCM, wiring harness and non-transmission related components.
No drive	Clutches and bands inoperative.	Disassemble the transmission, clean and inspect to locate area of concern.
Erratic shifts	Clutches and bands inoperative due to incorrect pressures.	Disassemble the transmission, clean and inspect to locate area of concern.
No dull thud heard	Clutches, bands and fluid passages may be damaged or obstructed.	Disassemble the transmission, clean and inspect to locate area of concern.
No movement felt	Clutches, bands and fluid passages may be damaged or obstructed.	Disassemble the transmission, clean and inspect to locate area of concern.
Hissing sound heard	Clutch seals or check ball may be damaged or leaking.	Disassemble the transmission, clean and inspect to locate area of concern.
Servos do not operate	Seals and pistons may be damaged. Supply and release ports may be obstructed. Spring may be broken.	Disassemble the transmission, clean and inspect to locate area of concern.
Multiple clutches are applied	Fluid passages in the center support or the clutch cylinders may be obstructed.	Disassemble the transmission, clean and inspect to locate area of concern. Check fluid passages in the center support for obstructions.

Leakage Inspection

Special Tool(s)

ST1300-A	100W/12 Volt DC UV Lamp 164-R0751 or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V
Automatic Transmission/Power Steering Dye 164-R3701 or equivalent	—

Leak Check Test with A Black Light

Automatic Transmission/Power Steering Dye 164-R3701 or equivalent (specifically formulated for ATF) is used to detect a transmission fluid leak.

1. Add Automatic Transmission/Power Steering Dye to the transmission fluid. Use one 30.0 mL (1 oz) of dye solution for every 3.8L (4 quarts) of transmission fluid.

2. Start and run the engine until the transaxle reaches its normal operating temperature. Observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Raise the vehicle on a hoist and run the engine at fast idle, then at engine idle, occasionally shifting to the DRIVE and REVERSE ranges to increase pressure within the transaxle. Observe the front of the flexplate, back of the cylinder block (in as far as possible), inside the torque converter housing and the entire case until fluid leakage is evident and the probable source of leakage can be determined.

External Fluid Leaks

Leak Path	Possible Source
Leaks at the fluid pan to case	• Pan bolts not tightened to specification. • Pan gasket damaged. • Case pan rail damaged.
Fluid cooler lines or fittings leaking	• Cooler line(s), cooler line fitting(s) damaged. Refer to Section 307-02 . • Cooler line fitting to case union damaged. Refer to Section 307-02 . • Case damage at case fitting. •

Fluid cooler line nut-to-case fittings leaking	• Damaged or missing O-ring seals. Refer to Section 307-02 . • Fitting(s) not tightened to specifications. Refer to Section 307-02 .
Leaks at the fluid cooler	• Fluid cooler damage. Refer to Section 307-02 . • Fitting(s) damaged or not tightened to specifications. Refer to Section 307-02 .
Leaks at external sensors	• Damaged or missing O-ring seals. • Screw not tightened to specification.
Leaks at the manual control lever seal	• Damaged or missing lever seal.
Leaks at the solenoid body harness connector	• Solenoid body harness connector O-ring seal(s), either on the harness end or the solenoid body, damaged or missing.
Fluid leakage in torque converter area	• For possible sources, refer to Fluid Leakage in the Torque Converter Area Chart.

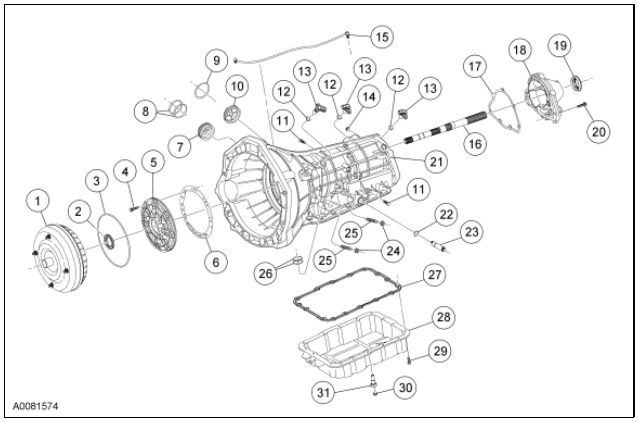
External Sealing

NOTICE: **Do not try to stop a fluid leak by increasing the torque beyond specifications. This may cause damage to the transmission case threads.**

The transmission has the following parts to prevent external fluid leakage:

- Gaskets
- Lip-type seals
- O-ring seals
- Seal rings
- Seal grommets
- Seal washers
- Thread sealant

External Sealing



Item	Part Number	Description
1	7902	Torque converter assembly
2	7A248	Seal assembly — front fluid pump
3	7A248	Seal — front fluid pump

4	W704892-S300	Screw and washer assembly (8 required)
5	7G187	Fluid pump
6	7A136	Gasket — fluid pump
7	7D027	Cover — overdrive servo
8	W703119-S300	Seals — overdrive servo cover (2 required)
9	W702969-S300	Seal — intermediate servo cover
10	7D027	Cover — intermediate servo
11	390318-S2	Plugs — pipe (2 required)
12	W702981-S300	O-ring seals — sensor-to-case (3 required)
13	7H103	Sensor assembly — (3 required)
14	6026	Plug — case
15	7034	Vent assembly
16	7060	Shaft — output
17	7086	Gasket — extension housing
18	7A039	Extension housing assembly
19	7052	Seal — extension housing
20	W500311-S309	Screw — extension housing (7 required)
21	7005	Case assembly
22	7B498	Seal — manual lever
23	7A256	Manual lever
24	7C492	Screw — band adjuster (2 required)
25	71000-S100	Nuts — band adjuster (2 required)
26	W705928-S300	O-ring seals (2 required)
27	7A191	Gasket — fluid pan
28	7A194	Fluid pan
29	W500213-S309	Screw — fluid pan (16 required)
30	W704999	Plug — short hex
31	7A101	Plug — fluid drain

External Sealing

NOTICE: **Do not try to stop a fluid leak by increasing the torque beyond specifications. This may cause damage to the transmission case threads.**

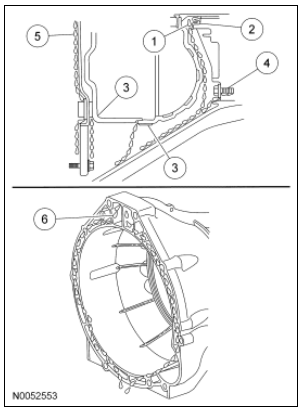
The transmission has the following parts to prevent external fluid leakage:

- Gaskets
- Lip-type seals
- O-ring seals
- Seal rings
- Seal grommets
- Seal washers
- Thread sealant

Fluid Leakage In Torque Converter Area

Leakage at the front of the transmission, as evidenced by fluid around the torque converter housing part of the case, may have several sources. By careful observation, it is possible in many instances to pinpoint the source of the leak before removing the transmission from the vehicle.

The paths, which the fluid takes to reach the bottom of the torque converter housing part of the case, are shown in the illustration. The 5 numbers in the illustration correspond with the 5 flow path steps.



Leak Path	Symptom	Possible Source
1, 2 and 4	Leak at the front of the transmission	Pump lip seal
1, 2 and 4	Leak at the front of the transmission	Converter hub weld
1, 2 and 4	Leak at the front of the transmission	External pump seal (large)
1, 2 and 4	Leak at the front of the transmission	Pump-to-case screws
1, 2 and 4	Leak at the front of the transmission	Pump gasket
3	Leak at the front of the transmission	Torque converter seal weld
3	Leak at the front of the transmission	Torque converter stud
5	Leak at the front of the transmission	Engine oil leak; rear main seal
5	Leak at the front of the transmission	Engine valve cover
5	Leak at the front of the transmission	Oil galley
5	Leak at the front of the transmission	Engine oil pressure sensor
6	Leak between engine and transmission case	Venting

Transmission Fluid Cooler

Special Tool(s)

ST2581-A	Transmission Fluid Fill Tool 307-437
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Transmission Fluid Cooler Flow Test

NOTICE: **Whenever a transmission has been disassembled to install new parts or a new or remanufactured transmission has been installed, a new transmission fluid cooler either in-tank, auxiliary or Oil-To-Air (OTA) if equipped, will need to be installed, otherwise transmission damage can occur.**

NOTICE: **Use only automatic transmission fluid specified for this transmission. Do not use supplemental fluid additives, treatments or cleaning agents. The use of these materials may affect transmission operation and result in internal damage to the transmission.**

NOTICE: **When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the transmission fluid cooler. These contaminants are a major cause of recurring transmission concerns and must be removed from the system before the transmission is put back into use.**

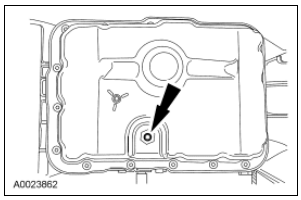
When evidence of transmission fluid contamination (such as metal particles, clutch plate material or band material) is found in the cooling system, the transmission fluid cooler flow test should be carried out.

If the transmission cooling system fails the transmission fluid cooler flow test, install a new transmission fluid cooler and flush out the fluid cooler lines. If installing a new transmission fluid cooler, use only factory-approved components.

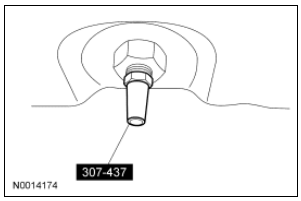
NOTICE: **The transmission fluid must be at normal operating temperature 85°-93°C (185°-200°F) to make sure that the cooler bypass is open. The cooler bypass is located in the main control valve body. The transmission fluid at normal operating temperature will be hot.**

NOTE: The engine idle, transmission selector lever cable adjustment, transmission fluid level and line pressure must be within specification before carrying out this test. Refer to Section 307-05 for adjustments. For information on engine idle diagnosis, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. For information on transmission fluid level check, refer to Transmission Fluid Level Check in this section. For information on line pressure, refer to Special Testing Procedures in this section.

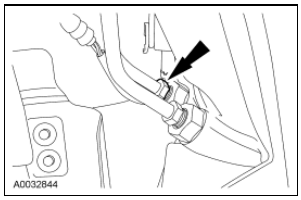
1. Place the transmission selector lever into PARK.
2. Raise the vehicle on a hoist and place suitable safety stands under the vehicle. Refer to Section 100-02 .
3. Hold the large fluid drain plug with a wrench, and remove the small (center) fluid level indicating plug using a 3/16-inch Allen key.



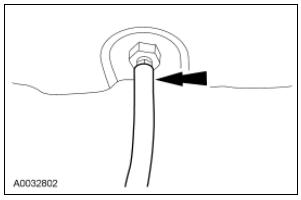
4. Install the Transmission Fluid Fill Tool into the pan.



5. Remove the transmission cooler return tube (upper tube) from the fitting on the transmission case.



6. Connect one end of a clear hose to the cooler return tube and route the other end of the hose to the Transmission Fluid Fill Tool in the pan.

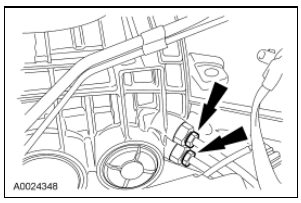


7. Remove the safety stands and lower the vehicle.
8. Install a scan tool.
9. Start the engine and run at idle.
10. With the engine running, raise the vehicle on a hoist and place suitable safety stands under the vehicle. Refer to Section 100-02 .

11. Monitor the TFT PID to verify that the transmission fluid is at normal operating temperature 85°C-93°C (185°F-200°F).

12. Once a steady flow of transmission fluid (without air bubbles) is observed, remove the hose from the Transmission Fluid Fill Tool and place the hose in a measuring container for 15 seconds. After 15 seconds, place the hose back onto the Transmission Fluid Fill Tool. Lower the vehicle and turn the engine OFF. Measure the amount of transmission fluid in the container. If adequate flow was observed, approximately 208 ml (7 oz) will be in the measuring container. The test is complete. Reconnect the cooler tube and install the fluid fill plug.

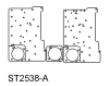
13. If the flow is not liberal, disconnect the hose from the cooler return tube and connect the hose to the cooler inlet (lower tube) on the transmission case. Reconnect the cooler return tube to the transmission cooler tube fitting-to-case (upper fitting) and tighten the transmission cooler tube nut-to-case fitting.
    - Tighten to 40 Nm (30 lb-ft).



14. Repeat Steps 8 through 11. If flow is now approximately 208 ml (7 oz) in 15 seconds, the cooler tubes and auxiliary cooler must be cleaned. Refer to Transmission Fluid Cooler Backflushing and Cleaning in this section. Carry out this entire test after the Transmission Fluid Cooler Backflushing and Cleaning procedure. If, after carrying out the Transmission Fluid Cooler Backflushing and Cleaning procedure, the flow is still not adequate, new cooler tubes and/or an auxiliary cooler must be installed. If the flow from the case is still not adequate after the installation of new cooler tubes and/or an auxiliary cooler (208 ml [7 oz] in 15 seconds), the pump and/or torque converter may be at fault. Carry out the appropriate procedures for diagnosis and repair in this section.

Diagnosis By Symptom

Special Tool(s)

 ST2538-A	Air Test Plate, Transmission 307-433-01, 307-433-02, 307-433-03
ST1137-A	73 III Automotive Meter 105-R0057 or equivalent
ST1761-A	Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1632-A	MLP-TR Cable 418-F107 (007-00111) or equivalent
ST1389-A	Transmission Tester 307-F016 (007-00130) or equivalent
ST1565-A	Pressure Gauge, Transmission Fluid 307-004 (T57L-77820-A)

The Diagnosis by Symptom Index gives the technician diagnostic information and direction, and suggests possible components using a symptom as a starting point.

Diagnosis by Symptom Index — Directions

1. Using the Symptom Index, select the concern/symptom that best describes the condition.

2. Refer to the routine indicated in the Diagnosis by Symptom Index.

3. Always begin diagnosis of a symptom with the following:
    1. Preliminary inspections.
    2. Verifications of condition.
    3. Checking the fluid levels.
    4. Carrying out other test procedures as directed.

4. **NOTE:** Not all concerns and conditions with electrical components will set a diagnostic trouble code (DTC). Be aware that the components listed may still be the cause.

NOTE: When the battery is disconnected or a new battery is installed, certain transmission operating parameters can be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Begin with the ROUTINE, if indicated. Follow the reference or action statements. Always carry out the on-board diagnostic tests as necessary. Never skip steps. Repair as necessary.

5. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to make sure that the repairs are complete.

Diagnosis by Symptom Index

Diagnosis by Symptom Index

5R55S	Routines
Engagement Concerns:	
• No Forward in D5 or D4 Only	201A
• No Forward Only (All Positions)	201B
• No Reverse Only	202
• Harsh Reverse Only	203
• Harsh Forward Only	204A
• Harsh Manual 1st Gear Only	204B
• Delayed/Soft Reverse Only	205
• Delayed/Soft Forward Only	206
• No Forward and No Reverse	207
• Harsh Forward and Harsh Reverse	208
• Delayed Forward and Delayed Reverse	209
Shift Concerns:	
• Some/All Shifts Missing (Automatic Mode Only)	210
• Timing Concern	
â— Early/Late (Some/All)	211
â— Erratic/Hunting (Some/All)	212
• Feel Concerns	

â— Soft/Slipping (Some/All)	213
â— Harsh (Some/All)	214
• No 1st Gear in Drive, Engages in a Higher Gear	215
• No 1st Gear in Manual 1st	216
• No Manual 2nd Gear	217
Torque Converter Clutch Operation Concerns:	
• Does Not Apply	240
• Always Applied/Stalls Vehicle	241
• Cycling/Shudder/Chatter	242
Other Concerns:	
• Selector Lever Efforts High	251
• External Leaks	252
• Noise/Vibration — Forward or Reverse	254
• Engine Will Not Crank	255
• No Park Range	256
• Transmission Overheating	257
• No Engine Braking in Manual 2nd Position	258
• No Engine Braking in Manual 1st Position	259
• Transmission Fluid Venting or Foaming	261
• Vehicle Movement with Gear Selector in "N"	262
• Slips/Chatters in Manual 1st Gear	263
• Slips/Chatters in Manual 2nd Gear	264
• No Engine Braking in Manual 3rd Position	280
• No Engine Braking in Manual 4th (D4) Position	281
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• Slips/Chatters in Manual 3rd Gear	
• Engine Braking in ALL Gears	283
• No 2nd and 5th Gears (Manual 2nd is OK)	284
• No 3rd, 4th and 5th Gears	285

Diagnostic Routines

Engagement Concern: No Forward in D5 or D4 Only

Possible Component	Reference/Action
201A — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoid B (PC B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Main Control	
• Screw not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
	• Inspect for damage. Repair as necessary.

• Seal rings or bearing damaged	
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Case	
• Damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: No Forward

Possible Component	Reference/Action
201B — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoid B (PC B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid	• Adjust the transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.

level	
• Transmission fluid condition	• Carry out the Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Main Control	
• Screw not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.

• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Forward Planetary Assembly	
• Planetary damage	• Inspect for damage. Repair as necessary.
Low One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Engagement Concern: No Reverse

Possible Component	Reference/Action
202 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoid C (PC C), shift solenoid B (SSB)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damage	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect or damage. Repair as necessary.
• Check ball damaged, missing, not seating, off	• Inspect for mislocation, poor seating, damage. Install a new cylinder.

location	
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
Reverse Drum Assembly	
• One-way clutch damaged	• Inspect for damage. Install a new drum assembly.
• Bearing damaged	• Inspect for damage. Install a new drum assembly.
Torque Converter Assembly	
• Torque converter internal failure preventing engagement, piston release	• Remove the transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.

Engagement Concern: Harsh Reverse ONLY

Possible Component	Reference/Action
203 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoid C (PC C)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	

• High pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, spring damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
	• Inspect for damage. Repair as necessary.

• Bronze seal ring or bearing damaged	
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
Reverse Drum Assembly	
• One-way clutch damaged	• Inspect for damage. Install a new drum assembly.
• Bearing damaged	• Inspect for damage. Install a new drum assembly.

Engagement Concern: Harsh Forward ONLY

Possible Component	Reference/Action
204A — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoid A (PC A), pressure control solenoid C (PC C)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High Pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.

	• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
	• Contamination	• Disassemble and clean.
	• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
	• Filter damaged, missing	• Inspect for damage, repair as necessary.
Center Support		
	• Screw not tightened to specification	• Tighten to specification.
	• Seal rings or bearing damage	• Inspect for damage. Repair as necessary.
	• Outside diameter of case bore damage	• Inspect for damage. Repair as necessary.
	• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly		
	• Seals, piston damaged	• Inspect for damage. Repair as necessary.
	• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
	• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
	• Return springs damaged	• Inspect for damage. Repair as necessary.
	• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: Harsh Manual 1st Gear ONLY

Possible Component		Reference/Action
204B — ROUTINE		
Powertrain Control System		
	• PCM, vehicle wiring harnesses, pressure control solenoid B (PC B),	• Carry out on-board diagnostic tests. For additional information, refer to the Powertrain

	turbine shaft speed (TSS) sensor	Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
		• GO to Pinpoint Test D and GO to Pinpoint Test E .
		• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.

Engagement Concern: Delayed or Soft Reverse ONLY

Possible Component	Reference/Action
205 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoid C (PC C)	• Carry out on-board diagnostic tests. For additional information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect pressures	
• Low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Direct Clutch Assembly	

• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: Delayed/Soft Forward ONLY

Possible Component	Reference/Action
206 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoid B (PC B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• Low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	

• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, spring damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged.	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.

• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction element damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: No Forward and No Reverse

Possible Component	Reference/Action
207 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoid B (PC B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust the transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Selector Lever Cable/Digital TR Sensor	
• Selector lever cable system or digital transmission range (TR) sensor damaged, misaligned	• Inspect and repair as necessary. Refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Main Control	
• Screws not tightened to specification	• Tighten screws to specification.

• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Input Shaft	
• Damaged	• Inspect for damage. Repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs, or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Overdrive Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Center Shaft Assembly	
• Damaged. One-way clutch damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Forward Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Reverse Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Output Shaft	
• Damage	• Inspect for damage. Repair as necessary.
Torque Converter	
• Damaged flexplate or adapter plate	• Remove the transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.
• Damaged impeller hub	
• Damaged turbine hub	
Direct One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Engagement Concern: Harsh Forward and Harsh Reverse

Possible Component	Reference/Action
208 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test B and GO to Pinpoint Test C .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust the transmission fluid to the correct level. For additional information, refer to Transmission Fluid Level

	Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. For additional information, refer to Preliminary Inspection .
Incorrect Pressures	
• High pressures	• Carry out Line Pressure Test, refer to Special Testing Procedures in this section. Follow pressure diagnosis and repair as required.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: Delayed Forward and Delayed Reverse

Possible Component	Reference/Action
209 — ROUTINE	
Powertrain Control System	

• PCM, vehicle wiring harnesses, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test B .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust the transmission fluid to the correct level. For additional information, refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. For additional information, refer to Preliminary Inspection .
Incorrect Pressures	
• High pressures	• Carry out Line Pressure Test, refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves and springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.

• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs, or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.

Shift Concern: Some/All Shifts Missing (Automatic Mode Only)

Possible Component	Reference/Action
210 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, B, C (PC A, B, C), torque converter clutch (TCC) solenoid, pressure control solenoids A, B, C, output shaft speed (OSS) sensor, digital TR sensor, intake air temperature (IAT) sensor, vehicle speed sensor (VSS) input	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT and VSS.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Some Shifts Missing ONLY	
	• If only some shifts are missing, determine which shift(s) is missing.
	• Refer to the following routine(s) for further No Shift concerns: ♦ No 1-2 Shift, Routine 220 ♦ No 2-3 Shift, Routine 221 ♦ No 3-4 Shift, Routine 222 ♦ No 4-5 Shift, Routine 270 ♦ No 5-4 Shift, Routine 271 ♦ No 4-3 Shift, Routine 223 ♦ No 3-2 Shift, Routine 224 ♦ No 2-1 Shift, Routine 225
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust the transmission fluid to correct level, refer to the in this section.

• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. For additional information, refer to Preliminary Inspection in this section.
Selector Lever Cable/Digital Transmission Range (TR) Sensor	
• Selector lever cable system or digital TR sensor damaged, misaligned	• Inspect and repair as necessary. For additional information, refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs, or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
OD Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Center Support	

• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Shift Concern: Timing Concerns—Early/Late

Possible Component	Reference/Action
211— ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, output shaft speed (OSS) sensor, intake air temperature (IAT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM and IAT.
	• GO to Pinpoint Test E .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Some Shifts Early/Late ONLY	
	• If only some shifts are early/late, determine which shift(s) is missing.
	• Refer to the following routine(s) for further No Shift concerns: ♦ Soft/Slipping 1-2 Shift, Routine 226 ♦ Soft/Slipping 2-3 Shift, Routine 227 ♦ Soft/Slipping 3-4 Shift, Routine 228 ♦ Soft/Slipping 4-5 Shift, Routine 272 ♦ Soft/Slipping 5-4 Shift, Routine 273 ♦ Soft/Slipping 4-3 Shift, Routine 229

	♦ Soft/Slipping 3-2 Shift, Routine 230 ♦ Soft/Slipping 2-1 Shift, Routine 221
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust the transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Timing Concerns—Erratic/Hunting (Some/All)

Possible Component	Reference/Action
212 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring	• Carry out on-board diagnostic tests. For additional

harnesses, output shaft speed (OSS) sensor, intake air temperature (IAT) sensor	information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM and IAT.
	• GO to Pinpoint Test E .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust the transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Further Diagnosis	
• For further diagnosis for timing issues, refer to Reference/Action	• Refer to the following routine(s) for specific diagnosis: • No 1-2 Shift, Routine 220 • No 2-3 Shift, Routine 221 • No 3-4 Shift, Routine 222 • No 4-5 Shift, Routine 270 • No 5-4 Shift, Routine 271 • No 4-3 Shift, Routine 223 • No 3-2 Shift, Routine 224 • No 2-1 Shift, Routine 225

	• Soft/Slip 1-2 Shift, Routine 226 • Soft/Slip 2-3 Shift, Routine 227 • Soft/Slip 3-4 Shift, Routine 228 • Soft/Slip 4-5 Shift, Routine 272 • Soft/Slip 5-4 Shift, Routine 273 • Soft/Slip 4-3 Shift, Routine 229 • Soft/Slip 3-2 Shift, Routine 230 • Soft/Slip 2-1 Shift, Routine 231 • Harsh 1-2 Shift, Routine 232 • Harsh 2-3 Shift, Routine 233 • Harsh 3-4 Shift, Routine 234 • Harsh 4-5 Shift, Routine 274 • Harsh 5-4 Shift, Routine 275 • Harsh 4-3 Shift, Routine 235 • Harsh 3-2 Shift, Routine 236 • Harsh 2-1 Shift, Routine 237

Engagement Concern: Feel—Soft/Slipping (Some/All)

Possible Component	Reference/Action
213 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, B, C, pressure control solenoids A, B, C, D (PC A, B, C, D), intermediate shaft speed sensor, transmission fluid temperature (TFT) sensor, intake air temperature (IAT) sensor, vehicle speed sensor (VSS) input	• Carry out on-board diagnostic tests. For additional information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT and VSS.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Some Shifts Soft/Slipping ONLY	
	• If only some of the shifts are soft/slipping, determine which shift(s) is missing.
	• Refer to the following routine(s) for further Soft/Slipping concerns: ♦ Soft/Slipping 1-2 Shift, Routine 226 ♦ Soft/Slipping 2-3 Shift, Routine 227 ♦ Soft/Slipping 3-4 Shift, Routine 228 ♦ Soft/Slipping 4-5 Shift, Routine 272

	♦ Soft/Slipping 5-4 Shift, Routine 273 ♦ Soft/Slipping 4-3 Shift, Routine 229 ♦ Soft/Slipping 3-2 Shift, Routine 230 ♦ Soft/Slipping 2-1 Shift, Routine 231
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust the transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs, or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Coast Clutch Assembly	

• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearings damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damage	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.

• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Case	
• Damaged	• Inspect for damage. Repair as necessary.
Torque Converter Assembly	
• Torque converter internal failure preventing engagement, piston release	• Remove the transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in the General Procedures portion of this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.

Shift Concern: Feel—Harsh (Some/All)

Possible Component	Reference/Action
214— ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, B, C, pressure control solenoids A, B, C, D (PC A, B, C, D), intermediate shafts speed sensor, digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor, intake air temperature (IAT) sensor, vehicle speed sensor (VSS) input	• Carry out on-board diagnostic tests. For additional information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT and VSS.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.

Some Shifts Harsh ONLY	
	• If only some of the shifts are harsh, determine which shift(s) is missing.
	• Refer to the following routine(s) for further No Shift concerns: ♦ Harsh 1-2 Shift, Routine 232 ♦ Harsh 2-3 Shift, Routine 233 ♦ Harsh 3-4 Shift, Routine 234 ♦ Harsh 4-5 Shift, Routine 274 ♦ Harsh 5-4 Shift, Routine 275 ♦ Harsh 4-3 Shift, Routine 235 ♦ Harsh 3-2 Shift, Routine 236 ♦ Harsh 2-1 Shift, Routine 237
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust the transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test, refer to Special Testing Procedures in this section. Follow pressure diagnosis and repair as required.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck, or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Input Shaft	
• Damaged	• Inspect for damage. Install new as necessary.
Overdrive Servo	

• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Center Shaft Assembly	
• Center shaft assembly damaged	• Inspect for damage. Repair as necessary.
• One-way clutch damaged	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	

• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Output Shaft	
• Damaged	• Inspect for damage. Install new as necessary.
Case	
• Damaged	• Inspect for damage. Repair as necessary.

Shift Concern: No 1st and 2nd Gear in Drive, Engages in a Higher Gear

Possible Component	Reference/Action
215 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, B, C, digital transmission range (TR) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test C .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.

• Filter damaged, missing	• Inspect for damage, repair as necessary.
OD Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Direct One-way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Engagement Concern: No 1st Gear in Manual 1 Position

Possible Component	Reference/Action
216 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, B, pressure control solenoids B, C (PC B, C)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged,	• If damaged or parts are missing, install new main control

misassembled, missing, stuck or bore damaged	assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: No 2nd Gear in Manual 2 Position

Possible Component	Reference/Action
217 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, B, C, pressure control solenoid B (PC B)	• Carry out on-board diagnostic tests. For additional information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs	• If damaged or parts are missing, install a new main control

damaged, misassembled, missing, stuck or bore damaged	assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Torque Converter Operation Concerns: Does Not Apply

Possible Component	Reference/Action
240 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor and engine coolant temperature (ECT) sensor	• Carry out on-board diagnostic tests. For additional information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test B .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.

Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Torque Converter Assembly	
• Torque Converter internal failure preventing engagement, piston application	• Remove the transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.

Torque Converter Operation Concern: Always Applied/Stalls Vehicle

Possible Component	Reference/Action

241 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid	• Carry out on-board diagnostic tests. For additional information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Low One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Torque Converter Assembly	
• Torque Converter internal failure preventing engagement, piston release	• Remove the transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.

Torque Converter Operation Concern: Cycling/Shudder/Chatter

Possible Component	Reference/Action
242 — ROUTINE	
Powertrain Control System	

• PCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid	• Carry out on-board diagnostic tests. For additional information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A .
	• Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Transmission fluid condition—contaminated, degraded	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section. If contaminated, locate source of contamination. If burnt, inspect mechanical bands, clutches. Repair as necessary. Change transmission fluid. Carry out drain and refill procedure. Refer to Transmission Fluid Drain and Refill — Without Torque Converter Drain Plug in this section. Carry out fluid cooler and torque converter cleaning procedure. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Torque Converter Assembly	
• Torque converter internal leakage, clutch material damaged	• Remove the transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.

Other Concerns: Selector Lever Efforts High

Possible Component	Reference/Action

251 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, digital transmission range (TR) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test C .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Selector Lever Cable, Digital TR sensor	
• Selector lever cable system or digital TR sensor damaged, misaligned	• Inspect and repair as necessary. For additional information, refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Case	
• Manual control lever assembly damage, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged	• Inspect for damage. If damaged, install a new part.
• Manual valve lever shaft retaining pin damaged	• Inspect for damage. If damaged, repair as necessary.

Other Concerns: External Leaks

Possible Component	Reference/Action
252 — ROUTINE	
Powertrain Control System	
• OSS sensor, intermediate shaft speed, turbine shaft speed (TSS) sensor, digital transmission range (TR) sensor	• Inspect for leakage. If areas around sensor show signs of leakage, install a new sensor O-ring seal. If area behind digital TR sensor shows signs of a leak, a new manual lever shaft seal may need to be installed.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Case	
• Case vent damaged	• Inspect for damage. If damaged, repair as necessary.
• Output shaft flange damage	• Inspect for damage. If damaged, repair as necessary.
Seals/Gaskets	
• Leakage at gaskets, seals, cooler lines, torque converter studs, etc.	• Refer to Leakage Inspection in this section for potential leak locations.
	• Remove all traces of lubricant on exposed surfaces of the transmission. Check vent for free breathing. Operate the vehicle at normal temperatures and carry out leak check test, refer to Leakage Inspection in this section. Repair as necessary.
Vents	
• Transmission fluid leakage through the vent system into the bellhousing	• Incorrect transmission fluid level may cause the transmission fluid to vent. If not already carried out, verify and adjust the fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
	• Verify the transmission operating temperature by monitoring TFT while driving the vehicle for 32 km (20 mi) or 20 minutes. If the TFT exceeds 102°C (215°F) during the drive, refer to routine No. 257 Transmission Overheating, Main Control, Thermostatic by-pass valve.
	• Remove all traces of transmission fluid on exposed surfaces of the transmission.
	• Check the vent for damage and obstructions. Verify that the vent is operating correctly by applying air through the vent tubes. If the vent is damaged or obstructed, repair as necessary.

Other Concern: Noise/Vibration—Forward or Reverse

Possible Component	Reference/Action
254 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, pressure control solenoids A, B, C (PC A, B, C)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Selector Lever Cable/Digital Transmission Range (TR) Sensor	
• Selector lever cable or digital TR sensor damaged, misaligned	• Inspect and repair as necessary. For additional information, refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck, or bore damaged, thermostatic bypass valve damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.

• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Low One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Flexplate or Adapter Plate	
• Damaged	• Inspect for damage. Repair as necessary.
• Nuts not tightened to specification	• Tighten to specification.
• Adapter plate not aligned correctly	• Remove transmission and using special service tool and procedure in this section, align adapter plate.
Clutch Assemblies	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for damage, mislocation, poor seating. Install a new cylinder as necessary.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Torque Converter Assembly	
• Torque converter hub damaged	• Inspect for damage. Repair as necessary.

Other Concern: Engine Will Not Crank

Possible Component	Reference/Action
255 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, digital	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

transmission range (TR) sensor	
	• GO to Pinpoint Test C .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Selector Lever Cable/Digital TR Sensor	
• Selector lever cable or digital TR sensor damaged, misaligned	• Inspect and repair as necessary. For additional information, refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Main Control/Park System/TR Sensor Alignment	
• Detent spring, rooster comb, manual lever and TR sensor are not correctly aligned together	• Disconnect TR sensor electrical connector. Remove outer manual lever nut. Loosen TR sensor screws. Loosen detent spring screw. Move manual lever through all gear ranges. Place manual lever into the NEUTRAL position. Tighten the detent spring screw to correct specification. Install TR sensor alignment tool. Tighten the TR sensor screws alternating sequence until correct tightening specification is obtained. Remove tool. Install outer manual lever and nut. Tighten nut to correct specification. Install TR sensor connector. Verify that the vehicle will start in PARK and NEUTRAL. Verify that the reverse backup lamps illuminate in REVERSE.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves,	• Inspect for damage. Install a new seal or flow control valve.

springs or seals damaged, stuck or not assembled correctly	
Flexplate or Adapter Plate	
• Damaged	• Inspect for damage. Repair as necessary.

Other Concern: No Park Range

Possible Component	Reference/Action
256 — ROUTINE	
Selector Lever Cable/Digital Transmission Range (TR) sensor	
• Selector lever cable system or digital TR sensor damaged, misaligned	• Inspect and repair as necessary. For additional information, refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Case	
• Manual control lever assembly damage, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged	• Inspect for damage. If damaged, repair as necessary.
• Manual valve lever shaft retaining pin damaged	• Inspect for damage. If damaged, repair as necessary.
Park System	
• Park gear, parking pawl, parking pawl return spring, park or guide plate, parking actuating rod, parking pawl shaft, manual lever, manual lever detent spring damaged or misassembled	• Inspect for damage. If damaged, repair as necessary.
• External linkages/brackets damaged	• Inspect for damage. If damaged, repair as necessary.

Other Concern: Transmission Overheating

Possible Component	Reference/Action
257 — ROUTINE	

Powertrain Control System	
• PCM, vehicle wiring harnesses, torque converter clutch (TCC) solenoid, pressure control solenoids A, B, C (PC A, B, C), transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Hydraulic/Mechanical	
• Thermostatic by-pass valve in the main control valve body assembly	• Verify correct thermal valve function while monitoring TFT. Drive the vehicle for about 32 km (20 miles) or 20 minutes. If the temperature exceeds 102°C (215°F) during the drive, then install a new main control valve body assembly.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged, thermostatic bypass valve damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Thermostatic by-pass valve damaged or malfunctioning.	• If the verification procedure confirms the malfunction, install a new main control valve body assembly. If not malfunctioning, inspect for damage. If damaged, install a new main control valve body assembly.
• Filter damaged, missing	• Inspect for damage, repair as necessary.

Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Case	
• Case vent damaged	• Inspect for damage. If damaged, repair as necessary.
Torque Converter Assembly	
• Seized torque converter one-way clutch	• Remove the transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.
• Excessive slip detected	
Other	
• Restriction in the transmission cooling system	• Refer to Section 307-02 for information and diagnosis of cooling system.
• Excessive trailer tow load	• Refer to the owner guide for specifications on trailer towing.
• Engine driveability concerns	• Check engine. Refer to Section 303-00 .

Other Concern: No Engine Braking in Manual 3rd Position

Possible Component	Reference/Action
280 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, B, C, reverse pressure (RP) switch, pressure control solenoids A, B (PC A, B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

	• GO to Pinpoint Test A , GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Coast Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seals rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.

• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Other Concern: No Engine Braking in Manual 4th (D) Position

Possible Component	Reference/Action
281 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid D, reverse pressure switch, pressure control solenoid B (PC B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.

• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
Coast Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Other Concerns: No Engine Braking in Manual 2nd Position

Possible Component	Reference/Action
258 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, C, D, pressure control solenoid A (PC A)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	

• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Other Concern: No Engine Braking in Manual 1st Position

Possible Component	Reference/Action
259 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoids A, C, D, pressure control solenoids A, B (PC A, B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to the correct level, refer to Transmission Fluid Level Check in this section.
Incorrect pressures	
• High/low pressures	• Check pressure at Line and PC C taps. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.

Other Concerns: Transmission Fluid Venting/Foaming

Possible Component	Reference/Action

261 — ROUTINE	
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
Case	
• Case vent damaged	• Inspect for damage. If damaged, repair as necessary.
Other	
• Transmission overheating	• Refer to 257 routine in this section.

Other Concern: Vehicle Movement with Gear Selector in "N" Position

Possible Component	Reference/Action
262 — ROUTINE	
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Selector Lever Cable/Digital Transmission Range (TR) sensor	
• Selector lever cable system or digital TR sensor damaged, misaligned	• Inspect and repair as necessary. For additional information, refer to Transmission Range (TR) Sensor Adjustment in this section.
Incorrect pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.

• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
Clutch Assemblies	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for damage, mislocation, poor seating. Install a new cylinder as necessary.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Case	
• Manual control lever assembly damage, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged	• Inspect for damage. If damaged, repair as necessary.
• Manual valve lever shaft retaining pin damaged	• Inspect for damage. If damaged, repair as necessary.

Other Concern: Slips/Chatters in Manual 1st Position

Possible Component	Reference/Action
263 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoids A, B (PC A, B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.

Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs, or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.

• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Other Concern: Slips/Chatters in Manual 2nd Position

Possible Component	Reference/Action
264 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoids A, B (PC A, B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	

• Incorrect transmission fluid level	• Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Overdrive Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.

Other Concern: Slip/Chatters in Manual 3rd Position

Possible Component	Reference/Action
282 — ROUTINE	

Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoids A, B (PC A, B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Direct One-way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Other Concern: Engine Braking in ALL Gears

Possible Component		Reference/Action
283 — ROUTINE		
Powertrain Control System		
	• PCM, vehicle wiring harnesses, shift solenoid D	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
		• GO to Pinpoint Test A .
		• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Torque Converter Assembly		
	• Torque converter internal failure preventing engagement, piston release	• Remove the transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.

Other Concern: No 2nd and 5th Gears (Manual 2nd is OK)

Possible Component		Reference/Action
284 — ROUTINE		
Powertrain Control System		
	• PCM, vehicle wiring harnesses, pressure control solenoids B, C (PC B, C)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
		• GO to Pinpoint Test D .
		• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.

Other Concern: No 3rd, 4th and 5th Gears

Possible Component	Reference/Action
285 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, pressure control solenoids A, B (PC A, B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Overdrive Planetary Assembly	

• Planetary damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 1-2 Shift

Possible Component	Reference/Action
232 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift control solenoid C, pressure control solenoids B (PC B), turbine shaft speed (TSS) sensor, digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.

• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 2-3 Shift

Possible Component	Reference/Action
233 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift control solenoid B, pressure control solenoids A (PC A), turbine shaft speed (TSS) sensor, intermediate shaft speed sensor, digital transmission range (TR) sensor, turbine shaft speed (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.

• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	

	• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 3-4 Shift

Possible Component	Reference/Action
234 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift control solenoid A, pressure control solenoids C (PC C), digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Center Support	
• Screws not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
	• Inspect for damage. Repair as necessary.

• Outside diameter of case bore damaged	
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.

Shift Concerns: Harsh 4-5 Shift

Possible Component	Reference/Action
274 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), turbine shaft speed (TSS) sensor, digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator.

• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seal (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 5-4 Shift

Possible Component	Reference/Action
275 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift control solenoid C, pressure control solenoid C (PC C), turbine shaft speed (TSS) sensor, digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	

• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 4-3 Shift

Possible Component	Reference/Action
235 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid A, pressure control solenoid A (PC A), digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , and GO to Pinpoint Test D .

	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 3-2 Shift

Possible Component	Reference/Action
236 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift control solenoid C, pressure control solenoid B (PC B), turbine shaft speed (TSS) sensor, intermediate shaft speed sensor, digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.

• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 2-1 Shift

Possible Component	Reference/Action
237 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift control solenoid C, pressure control solenoid B (PC B), turbine shaft speed (TSS) sensor, digital transmission range (TR) sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.

• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct Clutch One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: No 1-2 Shift

Possible Component	Reference/Action
220 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), output shaft speed (OSS) sensor, digital transmission range (TR) sensor, vehicle speed sensor (VSS) input	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM and VSS.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	

• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
OD Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.

Shift Concern: No 2-3 Shift

Possible Component	Reference/Action
221 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid B, torque converter clutch	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED)

(TCC) solenoid, pressure control solenoid A (PC A), output shaft speed (OSS) sensor, digital transmission range (TR) sensor	manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball, damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
Intermediate Band	

• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: No 3-4 Shift

Possible Component	Reference/Action
222 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid A, pressure control solenoid C (PC C), output shaft speed (OSS) sensor, digital transmission range (TR) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Center Support	
	• Tighten to specification.

• Screws not tightened to specification	
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for mislocation, poor seating, damage. Install a new cylinder.

Shift Concern: No 4-5 Shift

Possible Component	Reference/Action
270 — ROUTINE	
Powertrain Control System	

• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), output shaft speed (OSS) sensor, digital transmission range (TR) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
• Transmission control switch (TCS)	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
	• For TCS diagnosis, refer to Section 307-05 .
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: No 5-4 Shift

Possible Component	Reference/Action
271 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid C (PC C), output shaft speed (OSS) sensor, digital transmission range (TR) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
• Transmission control switch (TCS)	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
	• For TCS diagnosis, refer to Section 307-05 .
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.

• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: No 4-3 Shift

Possible Component	Reference/Action
223 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid A, B, pressure control solenoid A (PC A), output shaft speed (OSS) sensor, digital transmission range (TR) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.

Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: No 3-2 Shift

Possible Component	Reference/Action
224 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), output shaft speed (OSS) sensor, digital transmission range (TR) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	

• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.

Shift Concern: No 2-1 Shift

Possible Component	Reference/Action
225 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), output shaft speed (OSS) sensor, digital transmission range (TR) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.

Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring or bearing damaged	• Inspect for damage. Repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 1-2 Shift

Possible Component	Reference/Action

226 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), transmission fluid temperature (TFT) sensor, vehicle speed sensor (VSS) input	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Transmission Fluid	
• Incorrect transmission fluid level	• Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
• Transmission fluid condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	

• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 2-3 Shift

Possible Component	Reference/Action
227 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid A, pressure control solenoid A (PC A), intermediate shaft speed sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.

• Seals (piston and cover) damaged	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 3-4 Shift

Possible Component	Reference/Action
228 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid A, pressure control solenoid C (PC C), transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT

or bore damaged	stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 4-5 Shift

Possible Component	Reference/Action
272 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .

	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Feel — Soft/Slipping 5-4 Shift

Possible Component	Reference/Action
273 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid C (PC C),	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

transmission fluid temperature (TFT) sensor	
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: Feel — Soft/Slipping 4-3 Shift

Possible Component	Reference/Action
229 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid A, pressure control solenoid A (PC A), transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.

• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 3-2 Shift

Possible Component	Reference/Action
230 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), intermediate shaft speed sensor, transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged, missing	• Inspect for damage, repair as necessary.
Overdrive Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Overdrive Band	

• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

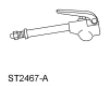
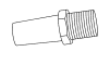
Shift Concern: Feel — Soft/Slipping 2-1 Shift

Possible Component	Reference/Action
231 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, shift solenoid C, pressure control solenoid B (PC B), transmission fluid temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , and GO to Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.
Incorrect Pressures	
• High/low pressures	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.

• Filter damaged, missing	• Inspect for damage, repair as necessary.

Transmission Fluid Level Check

Special Tool(s)

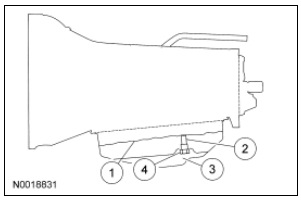
 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A)
ST2715-A	Fluid Transporter/Evacuator/Injector 307-D465
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent scan tool
 ST2581-A	Adapter, Fluid Level and Fill Plug 307-437

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Fluid Fill Reference

NOTE: Left side of case shown.



Item	Part Number	Description
1	—	Fluid level
2	7A010	Fluid level tube
3	W704999-S309	Fluid level and fill plug (small) (in-vehicle)
4	7A010	Fluid drain plug (large)

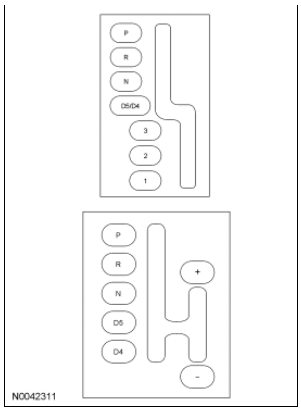
1. Using the diagnostic tool, monitor the transmission fluid temperature (TFT) using PID: TFT.

2. Start the vehicle.

3. **NOTE:** Engine idle speed is approximately 650 rpm.

   While proceeding with this procedure, run the engine until the transmission fluid temperature is between 27°C-49°C (80°F-120°F).

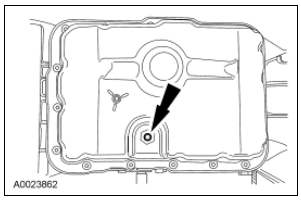
4. Move the range selector lever slowly through each gear, stopping in each position and allowing the transmission to engage.



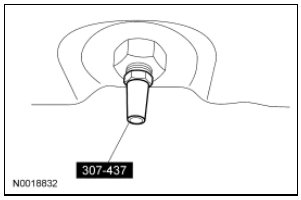
5. Place the range selector lever in the PARK position.

6. With the engine running, position the vehicle on a hoist and set it as close to level as possible. For additional information, refer to Section 100-02 .

7. Hold the larger drain plug with a wrench and remove the small (center) fluid level indicating plug.

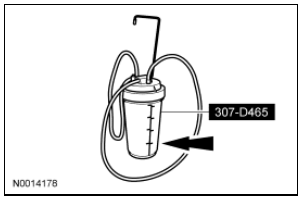


8. Install the special tool into the pan.

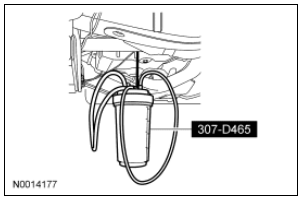


9. **NOTE:** Prior to filling the special tool with clean transmission fluid, make sure that the canister is clean.

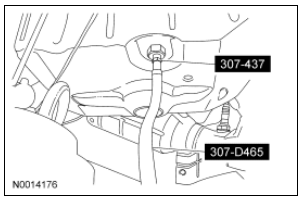
   Fill the special tool with clean automatic transmission fluid.



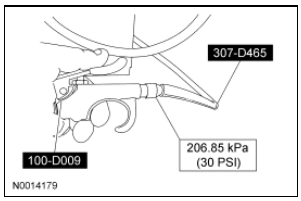
10. Hang the special tool under the vehicle. Position it upright and close to the transmission.



11. Connect the special tools.
    - Connect the open end of the fluid hose from the Fluid Transporter/Evacuator/Injector to the Fluid Level and Fill Plug Adapter at the bottom of the transmission fluid pan.



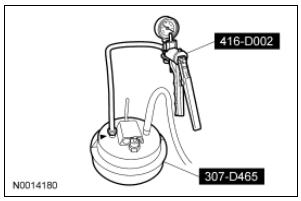
12. Apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the special tool. Fluid will immediately start flowing out of the special tool into the transmission fluid pan.



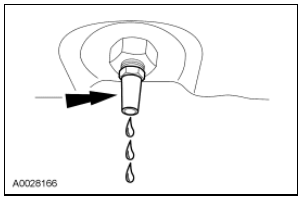
13. Add one pint of transmission fluid into the fluid pan. Stop the process by releasing the air pressure and removing the air nozzle from the end of the hose.

14. Inspect the fluid level in the special tool. If the fluid drains back into the canister, the transmission is full. If no fluid drains back, more fluid will need to be added. Repeat Steps 12 and 13.

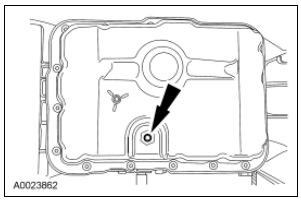
15. Once the transmission is full, place a hand vacuum pump on the open end of the vacuum/pressure hose of the special tool and apply vacuum to the system. This will pull out any extra fluid trapped in the system and direct it into the container.



16. Allow the fluid to drain. Make sure that the fluid temperature is between 27°C-49°C (80°F-120°F). When the fluid comes out as a thin stream or drip, the fluid is at the correct level.



17. Reinstall the small (center) fluid level indicating plug.
    - Tighten to 10 Nm (89 lb-in).



18. Check the operation of the transmission by moving the range selector lever slowly through each gear, stopping in each position and allowing the transmission to engage.

Transmission Fluid In-Line Filter

Material

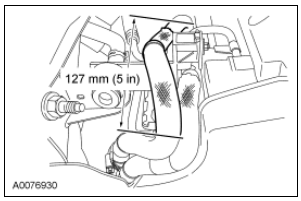
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

NOTE: Use the following guidelines for installing the transmission fluid in-line filter:

- If the transmission was overhauled and the vehicle was equipped with an in-line fluid filter, install a new in-line fluid filter.
- If the transmission was overhauled and the vehicle was not equipped with an in-line fluid filter, install a new in-line fluid filter kit.
- If the transmission is being installed for a non-internal repair, do not install an in-line filter or filter kit.
- If installing a Ford-authorized remanufactured transmission, install the in-line transmission fluid filter that is supplied.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Cut a section of the rubber hose to allow installation of the transmission fluid in-line filter.

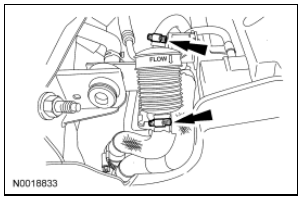


3. **⚠ CAUTION: The filter has a bypass valve in it. The red arrow on the filter indicates the direction of fluid flow through the filter. The filter must be installed in the fluid cooler return line with the red arrow on the filter pointing away from the transmission fluid cooler and toward the transmission (the return line has fluid coming out of the cooler going to the transmission). If the fluid filter is not installed correctly, it will cause internal transmission damage.**

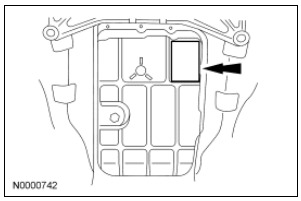
   ⚠ CAUTION: Do not install any rubber hoses or steel tubing with a bend entering the filter greater than 60 degrees.

   Install the one end of the filter into the rubber hose with a clamp, then install the other end of the filter into the rubber hose.

   - Install and tighten the 2 hose clamps.



4. Clean a visible section of the transmission fluid pan and install the sticker indicating that the vehicle is equipped with an in-line filter.



5. Fill the transmission with clean automatic transmission fluid.
    - Verify for correct operation.
    - Check the filter for leaks.

Transmission Fluid Drain and Refill — Automated Equipment

Special Tool(s)

	Automatic Transmission Flush and Fill Machine 211-00018 Automatic Transmission Flush and Fill Machine 199-00010 or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Draining

⚠ CAUTION: Use only clean automatic transmission fluid specified for this transmission. Do not use supplemental transmission fluid additives, treatments or clean agents. The use of these materials can affect transmission operation and result in damage to internal transmission components.

⚠ CAUTION: Always refer to the instructions supplied with the flush and fill machine.

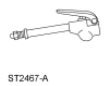
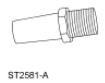
1. With the vehicle in PARK, position it on a hoist. For additional information, refer to Section 100-02 .
2. Use a suitable flush and fill machine to change the fluid.
3. When connecting the flush and fill machine, connect the machine to the fluid cooler tube after the fluid cooler on the cooler return line. This will help remove any foreign material trapped in the fluid coolers.

Refill

1. Use only clean automatic transmission fluid.
2. Once the fluid exchange has been completed, disconnect the flush and fill machine. Reconnect any disconnected fluid cooler tubes.
3. With the engine running, check and adjust the transmission fluid level, and check for any leaks. If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved. For additional information, refer to Transmission Fluid Level Check in this section.

Transmission Fluid Drain and Refill — Without Torque Converter Drain Plug

Special Tool(s)

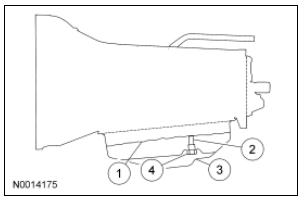
 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A)
ST2715-A	Fluid Transporter/Evacuator/ Injector 307-D465
 ST2581-A	Adapter, Fluid Level and Fill Plug 307-437
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication module (VCM) with appropriate adapters, or equivalent diagnostic tool

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Fluid Fill Reference

NOTE: Left side of case is shown.

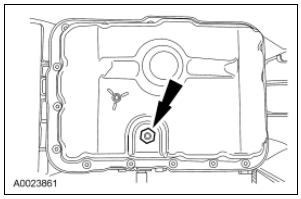


Item	Part Number	Description
1	—	Fluid level
2	7A010	Fluid level tube
3	W704999-S309	Fluid level and fill plug (small) (in-vehicle)
4	7A010	Fluid drain plug (large)

Draining

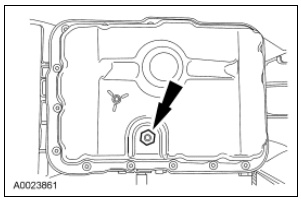
1. With the vehicle in NEUTRAL, position it on a hoist. Set the vehicle as close to level as possible. For additional information, refer to Section 100-02 .

2. Remove the drain plug (large plug) and allow the fluid to drain.

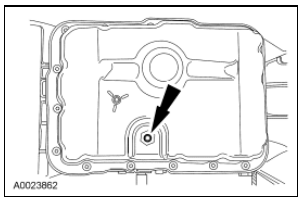


Filling

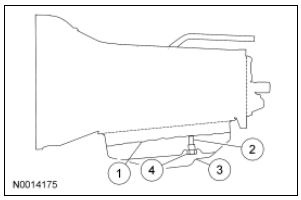
1. Install the fluid drain plug.
   - Tighten to 26 Nm (19 lb-ft).



2. Hold the larger drain plug with a wrench and remove the small (center) fluid level indicating plug.

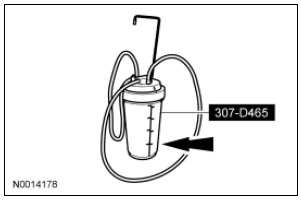


3. Install the special tool into the pan.

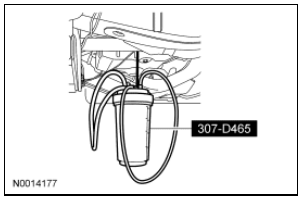


4. **NOTE:** Prior to filling the special tool with clean transmission fluid, make sure that the canister is clean.

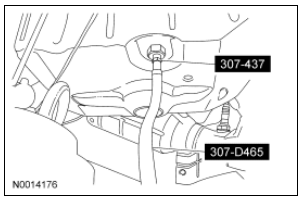
   Fill the special tool with clean automatic transmission fluid.



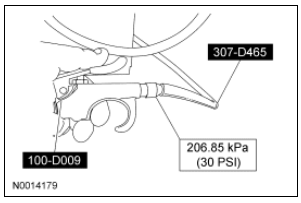
5. Hang the special tool under the vehicle, upright and close to the transmission.



6. Connect the special tools.
    - Connect the open end of the fluid hose from the Fluid Transporter/Evacuator/Injector to the Adapter, Fluid Level and Fill Plug at the bottom of the transmission fluid pan.



7. Apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the special tool. Fluid will immediately start flowing out of the special tool into the transmission fluid pan.



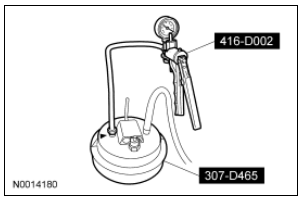
8. Add 2 or 3 quarts of transmission fluid into the fluid pan. Stop the process by releasing the air pressure and removing the air nozzle from the end of the hose.

9. **NOTE:** Engine idle speed is approximately 650 rpm.

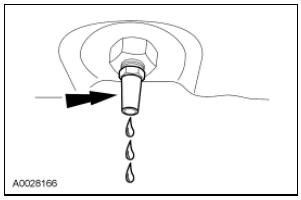
    Start and run the engine until the transmission fluid temperature is between 27°-49°C (80°-120°F).

10. Inspect the fluid level in the special tool. If the fluid drains back into the canister, the transmission is full. If no fluid drains back, more fluid will need to be added. Repeat Steps 8 and 9.

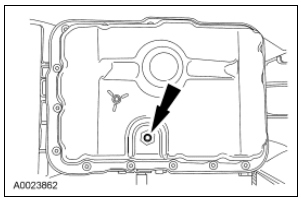
11. Once the transmission is full, place a hand vacuum pump on the open end of the vacuum/pressure hose of the special tool and apply vacuum to the system. This will pull out any extra fluid trapped in the system and direct it into the container.



12. Allow the fluid to drain. When the fluid comes out as a thin stream or drip, the fluid is at the correct level.



13. Reinstall the small (center) fluid level indicating plug using a 3/16-inch Allen key.
    - Tighten to 10 Nm (89 lb-in).



Transmission Fluid Cooler Backflushing and Cleaning

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTICE: **Whenever a transmission has been disassembled to install new parts or a new or remanufactured transmission has been installed, a new transmission fluid cooler, either in-tank, auxiliary or oil-to-air (OTA), if equipped will need to be installed, otherwise transmission damage can occur. Using a suitable torque converter/fluid cooler cleaner, clean and backflush the transmission fluid cooler tubes.**

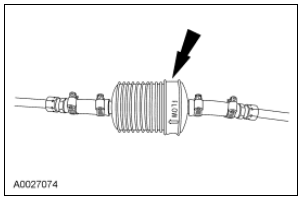
NOTICE: **Use only clean automatic transmission fluid specified for this transmission. Do not use supplemental fluid additives, treatments or cleaning agent. The use of these materials may affect transmission operation and result in internal damage to the transmission.**

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the transmission fluid cooler. These contaminants are a major cause of recurring transmission concerns and must be removed from the system before the transmission is put back in use.

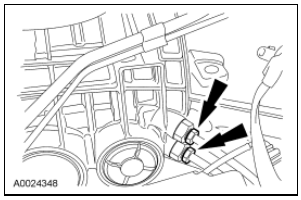
NOTE: Do not use any solvents while carrying out this procedure. Only use clean automatic transmission fluid.

1. Conduct backflushing with a suitable torque converter/transmission fluid cooler cleaner. Test the equipment to make sure that a vigorous fluid flow is present before proceeding. Install a new system filter if flow is weak or contaminated.

2. Remove and discard the in-line transmission fluid filter, if equipped.



3. To aid in attaching the cleaner to the transmission steel cooler lines, connect 2 additional rubber hoses to the transmission end of the steel transmission cooler lines as described.
    - Connect the cleaner tank pressure line to the steel transmission cooler return line (transmission case upper fitting).
    - Connect a tank return hose to the steel transmission cooler pressure line (transmission case lower fitting). Place the outlet end of this hose in the solvent tank reservoir.



4. Turn on the pump and allow the transmission fluid to circulate a minimum of 5 minutes (cycling switch on and off will help dislodge contaminants in the cooler system).

5. Switch off the pump and disconnect the pressure hose from the transmission cooler return line.

6. Use compressed air to blow out the cooler(s) and lines (blow air into the transmission cooler return line) until all the fluid is removed.

7. Remove the rubber return hose from the remaining steel cooler line.

Transmission Range (TR) Sensor Adjustment

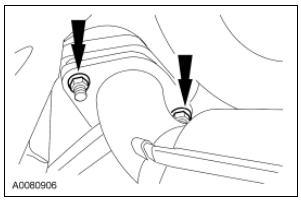
Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Adjust

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

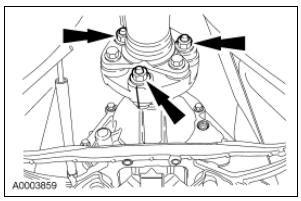
2. Loosen the 4 converter-to-manifold nuts.


A0080906

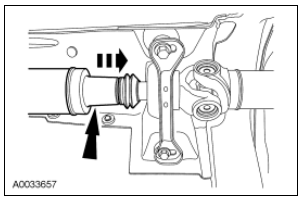
3. **⚠ CAUTION: Index-mark (color paint) the bolts, washers, nuts and the flex coupling to the transmission flange to make sure they are installed in the same location. Components that are not assembled in their original locations can cause driveshaft imbalance.**

   ⚠ CAUTION: Do not remove the bolts retaining the flex coupling to the driveshaft.

   Index-mark the front driveshaft pinion flange. Remove the 3 nuts, washers and bolts.


A0003859

4. Slide the front shaft assembly rearward and support.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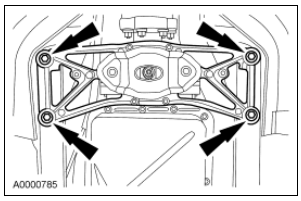
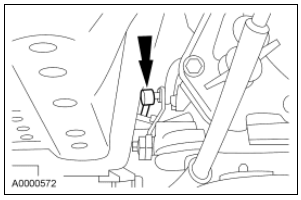
5. **⚠ WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions may result in personal injury.**

   Using a suitable transmission jack, support the transmission.

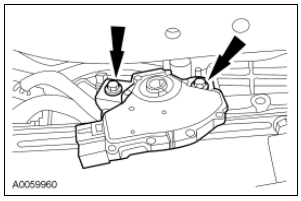
6. Remove the transmission mount and lower the transmission enough to gain access to the digital transmission range (TR) sensor.



7. Disconnect the shift cable from the manual control lever.



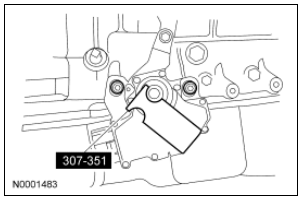
8. Loosen the screws.



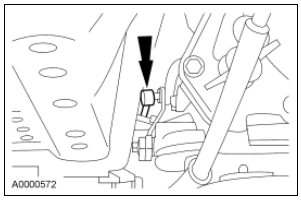
9. ⚠ **CAUTION: The digital TR sensor must fit flush against the case. Tightening one screw before tightening the other may cause the sensor to bind or become damaged.**

   Using the special tool, align the digital TR sensor and tighten the screws in an alternating sequence.

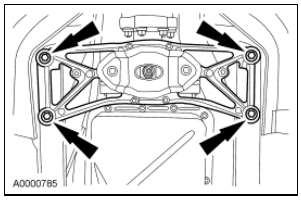
   - Tighten 8 Nm (71 lb-in).



10. Install the shift cable to the manual control lever.

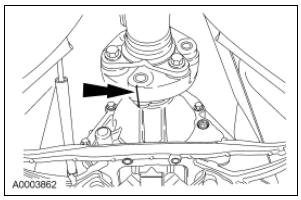


11. Raise the transmission up and install the rear transmission mount bolts. Remove the transmission jack.
    - Tighten to 55 Nm (41 lb-ft).



12. Verify that the shift cable is adjusted correctly. For additional information, refer to Section 307-05 .

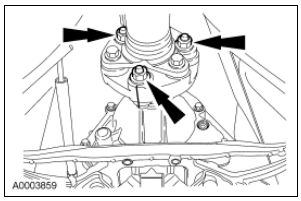
13. Install the driveshaft by aligning the index marks made during removal for correct driveshaft balance.



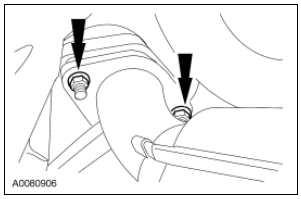
14. ⚠ **CAUTION: Install the bolts, washers and nuts in their original position or driveshaft imbalance can occur. Install the driveshaft flex coupling bolts with the head of the bolt seated against the flange and the nuts seated against the flex coupling.**

    Install the 3 nuts, washers and bolts.

    - Tighten to 81 Nm (60 lb-ft).



15. Install the 4 converter-to-manifold nuts.
    - Tighten to 40 Nm (30 lb-ft).



Torque Converter Contamination Inspection

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:
    - A torque converter malfunction has been determined based on complete diagnostic procedures.
    - The torque converter stud or studs, impeller hub or bushing are damaged.
    - The torque converter exhibits external discoloration (due to overheating).
    - There is evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes.
        - Major metallic failure
        - Multiple clutch plates or band failures
        - Sufficient component wear which results in metallic contamination
        - Water or antifreeze contamination

2. If none of the above conditions are present, continue with the following fluid inspection.

3. Pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter.

4. Examine the fluid for contaminants, color and smell. The fluid must be free of contaminants, red in color and not have a burnt smell.

5. ***NOTICE:*** **Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission damage will occur.**

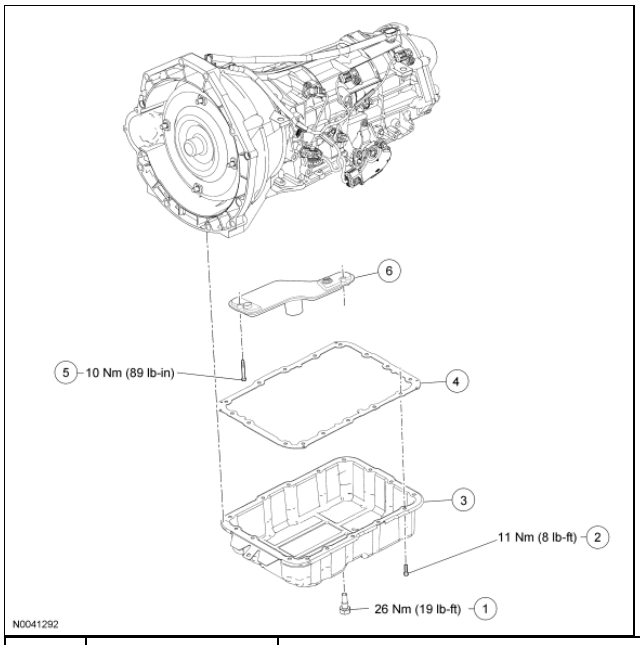
   If the fluid passed inspection:

    - drain the remaining fluid from the torque converter.
    - using only the recommended transmission fluid, add 1.9L (2 qt) of clean fluid into the converter and agitate by hand.
    - thoroughly drain the fluid.

Fluid Pan, Gasket and Filter

Material

Item	Specification
MERCONï¿½ V Automatic Transmission Fluid XT-5-QM	MERCONï¿½ V



Item	Part Number	Description
1	7A010	Transmission fluid pan drain plug
2	W500213	Transmission fluid pan-to-case screw (16 required)
3	7A194	Transmission fluid pan
4	7A191	Transmission fluid pan gasket
5	W705559	Transmission fluid filter screw (2 required)
6	7A098	Transmission fluid filter

Removal

⚠ CAUTION: Lubricate the fluid filter seals with clean automatic transmission fluid or they may be damaged.

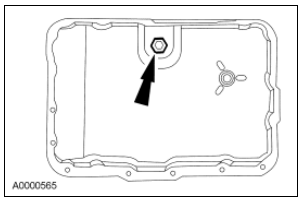
NOTE: Make sure that the fluid filter seals are correctly seated on the filter.

NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the gasket should be reused.

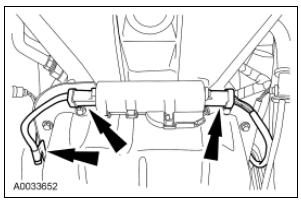
NOTE: Install a new transmission fluid filter.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

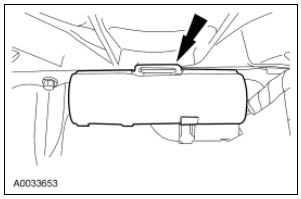
2. Remove the drain plug and drain the fluid.



3. Disconnect the heated oxygen sensor (HO2S) connectors and retaining clip from the RH pan rail and then position the connectors aside.

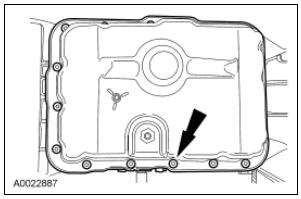


4. Remove the HO2S connector from the front of the transmission pan rail.

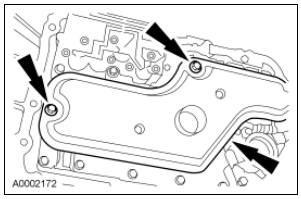


5. **NOTE:** The transmission fluid pan gasket is reusable; clean and inspect for damage. If not damaged, the gasket should be reused.

   Remove the transmission fluid pan and gasket.

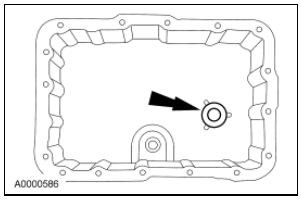


6. Remove and discard the transmission fluid filter.



Installation

1. Clean and inspect the transmission fluid pan and magnet.

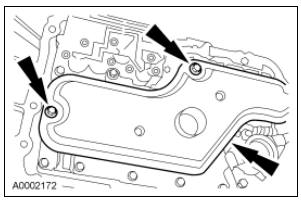


2. ⚠ **CAUTION: Lubricate the transmission fluid filter O-ring seals with clean automatic transmission fluid or the seals may be damaged.**

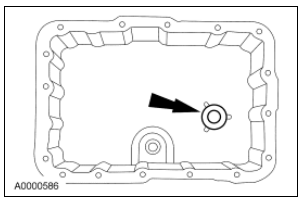
   NOTE: Make sure the transmission fluid filter seals are correctly seated on the filter.

   Lubricate the seals and install the transmission fluid filter and screws.

   - Tighten to 10 Nm (89 lb-in).

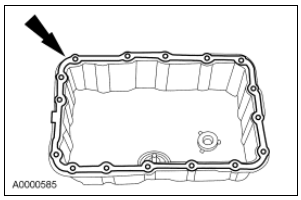


3. Install the fluid pan magnet in the transmission fluid pan.

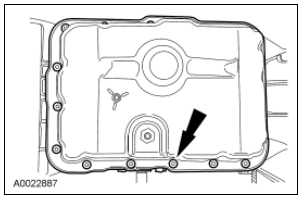


4. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage. If not damaged, the gasket should be reused.

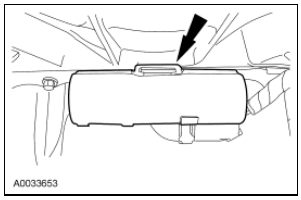
   Install the transmission fluid pan and gasket and loosely install the screws.



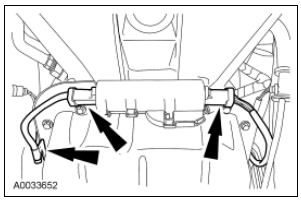
5. Tighten the screws in a crisscross sequence.
   - Tighten to 11 Nm (8 lb-ft).



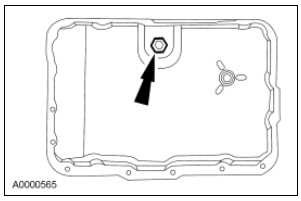
6. Install the HO2S connector to the front of the transmission pan rail.



7. Connect the HO2S connector and install the sensor wire retaining clip to the RH side of the transmission pan rail.



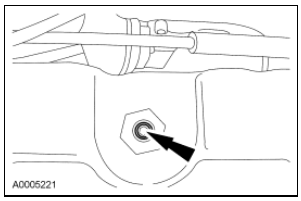
8. Install the drain plug.
   - Tighten to 26 Nm (19 lb-ft).



9. **NOTE:** It will be necessary to hold the drain plug with a wrench when removing the fluid level indicator plug.

   NOTE: Use a 3/16-inch Allen key to remove the fluid level indicator plug.

   Remove the fluid level indicator plug.



10. Carry out the fluid level check. Refer to Transmission Fluid Level Check in this section.

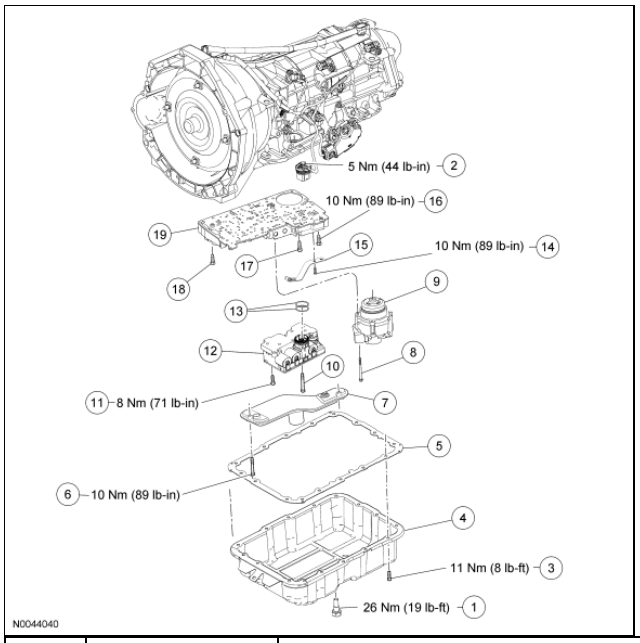
Main Control Valve Body

Special Tool(s)

ST1639-A	Aligner, Valve Body (2 required) 307-334 (T95L-70010-C)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V



Item	Part Number	Description
1	7A010	Transmission fluid pan drain plug
2	—	Solenoid body electrical connector screw
3	W500213	Transmission fluid pan-to-case screw (16 required)
4	7A194	Transmission fluid pan
5	7A191	Transmission fluid pan gasket
6	W705559	Transmission fluid filter screw (2 required)
7	7A098	Transmission fluid filter
8	W702359	Reverse servo screw (4 required)
9	7B193	Reverse servo assembly
10	W703189	Solenoid body screw (7 required)
11	W702921	Solenoid body screw

12	7G391	Solenoid body
13	W705928	Solenoid body O-rings
14	W500100	Manual valve detent spring screw
15	7E332	Manual valve detent spring
16	W500102	Main control valve body screw (18 required)
17	W702791	Main control valve body screw
18	W706672	Main control valve body screw
19	7A100	Main control valve body assembly

Removal

⚠ CAUTION: Lubricate the fluid filter seals with clean automatic transmission fluid or they may be damaged.

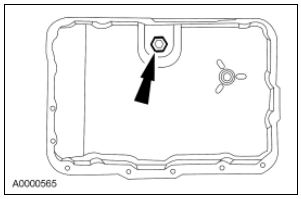
NOTE: Make sure that the fluid filter seals are correctly seated on the filter.

NOTE: Clean the area around the solenoid body connector contamination.

NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the gasket should be reused.

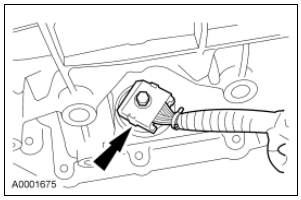
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the transmission fluid.

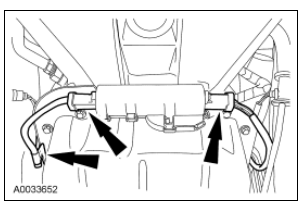


3. **NOTE:** Clean the area around the solenoid body connector to prevent contamination.

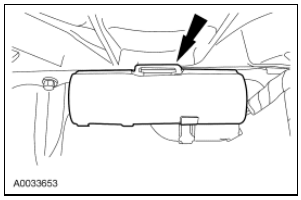
   Disconnect the solenoid body harness electrical connector.



4. Disconnect the heated oxygen sensor (HO2S) connectors and retaining clip from the RH pan rail and then position the connectors aside.

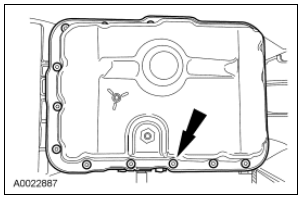


5. Remove the HO2S connector from the front of the transmission pan rail.

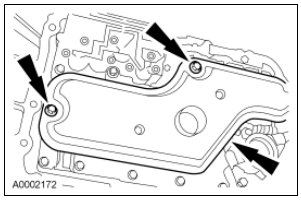


6. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect the gasket for damage. If not damaged, the gasket should be reused.

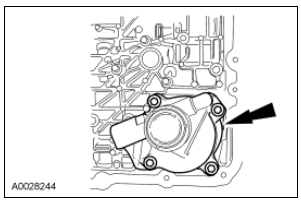
   Remove the transmission fluid pan and gasket.



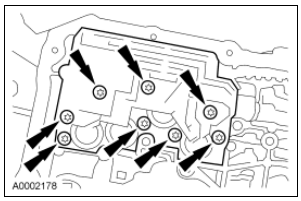
7. Remove the transmission fluid filter.



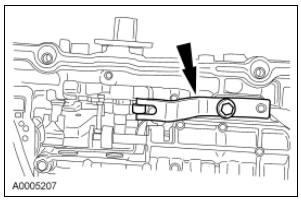
8. Remove the 4 screws attaching the reverse servo to the transmission case and remove the servo.



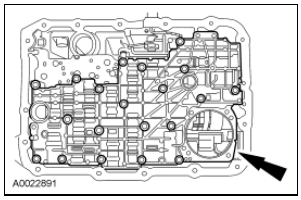
9. Remove the screws and the solenoid body.



10. Remove the manual control valve detent spring.

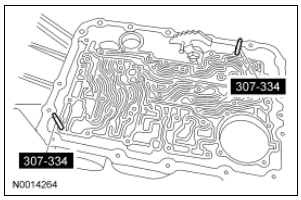


11. Remove the main control valve body bolts and the main control valve body assembly.

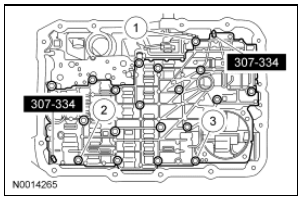


Installation

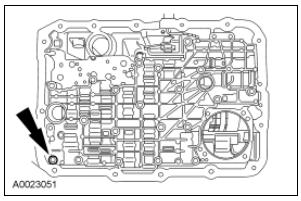
1. Install the special tools into the transmission case.



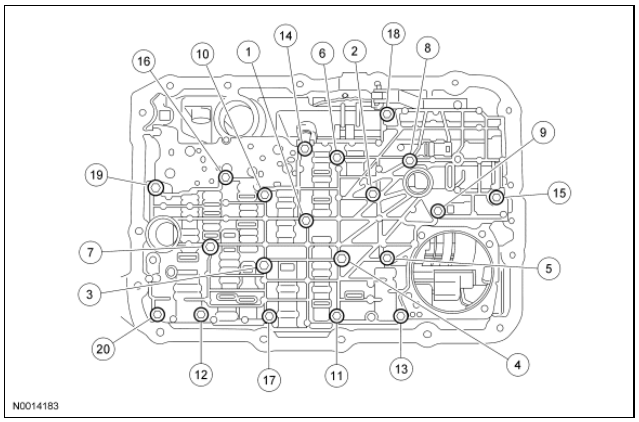
2. Using the special tools, install the main control valve body and loosely install the screws.
    1. Install the short screw.
    2. Install the screw with the larger head.
    3. Install the remaining screws.



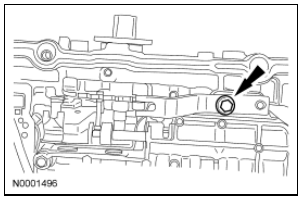
3. Remove the special tools, and loosely install the screw.



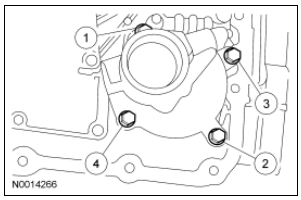
4. Tighten the screws in the sequence shown.
    - Tighten to 10 Nm (89 lb-in).



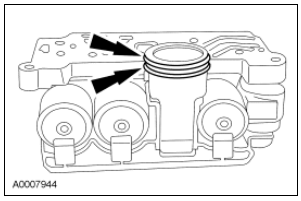
5. Install the manual control valve detent spring.
    - Tighten to 10 Nm (89 lb-in).



6. Install the reverse servo and the 4 screws in 2 stages, in the sequence shown.
    - Stage 1: Tighten to 5 Nm (44 lb-in).
    - Stage 2: Tighten to 11 Nm (8 lb-ft).



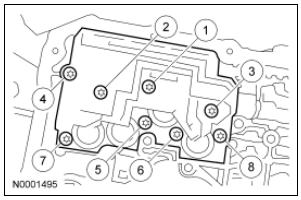
7. Install new O-ring seals on the solenoid body connector. Lubricate the O-ring seals with clean automatic transmission fluid.



8. ⚠ **CAUTION: Inspect the transmission case bore to make sure it is free of foreign material and not damaged. If it is damaged, transmission leak may occur.**

    Install the solenoid body. Tighten the screws in sequence shown.

    - Tighten to 8 Nm (71 lb-in).

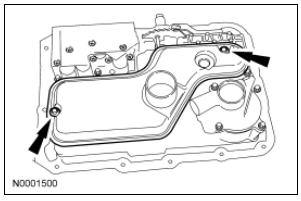


9. ⚠ **CAUTION: Lubricate the fluid filter seals with clean automatic transmission fluid or they may be damaged.**

    NOTE: Make sure that the fluid filter seals are correctly seated on the filter.

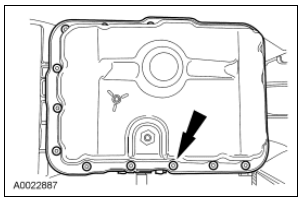
    Lubricate the seals and install the transmission fluid filter.

    - Tighten to 10 Nm (89 lb-in).

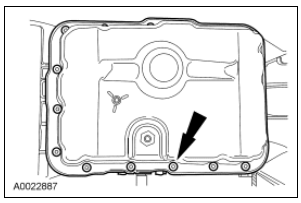


10. **NOTE:** The transmission fluid pan gasket is reusable; clean and inspect for damage. If not damaged, the gasket should be reused.

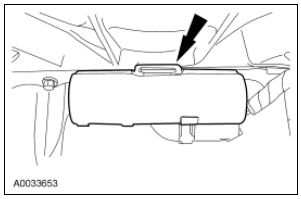
    Install the transmission fluid pan and gasket and loosely install the screws.



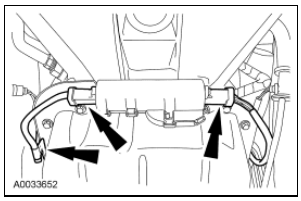
11. Tighten the screws in a crisscross sequence.
    - Tighten to 11 Nm (8 lb-ft).



12. Install the HO2S connector to the front of the transmission pan rail.



13. Connect the HO2S connector and install the sensor wire retaining clip to the RH side of the transmission pan rail.



14. ⚠ **CAUTION: Damage will occur to the solenoid body assembly if the screw is tightened above specification.**

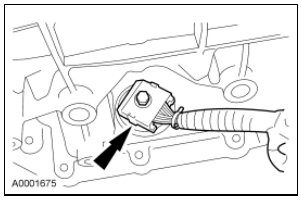
    NOTE: Always install new O-ring seals on the vehicle harness connector.

    NOTE: Clean the area around the connector to prevent contamination of the solenoid body connector.

    NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

    Install and lubricate new O-ring seals on the transmission connector and connect the connector.

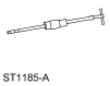
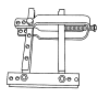
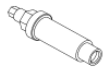
    - Tighten to 5 Nm (44 lb-in).

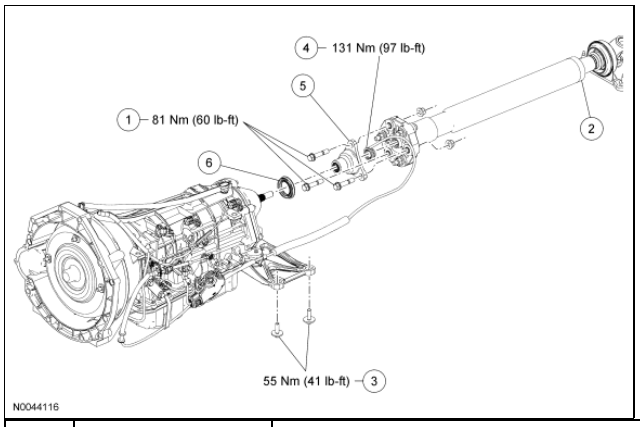


15. Fill the transmission to the correct level. For additional information, refer to Transmission Fluid Drain and Refill — Without Torque Converter Drain Plug in this section.

Extension Housing Seal

Special Tool(s)

 ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1758-A	Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)
ST2498-A	Installer, Drive Pinion Oil Seal 205-115
 ST2440-A	Installer, Drive Pinion Flange 205-479
ST2416-A	Installer, Output Shaft Flange 307-404
ST2937A	Remover, Output Shaft Flange 307-523



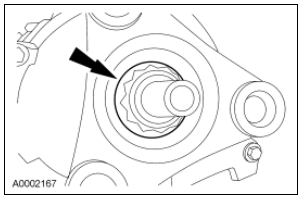
Item	Part Number	Description
1	W701357-S309	Transmission output shaft flange coupler bolts and nuts
2	4602	Driveshaft
3	W704971-S426	Transmission crossmember-to-floor pan screws
4	W701357	Transmission output shaft flange nut
5	7089	Transmission output shaft flange
6	7052	Extension housing seal

Removal

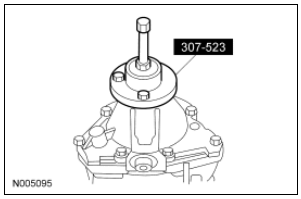
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the driveshaft. For additional information, refer to Section 205-01 .

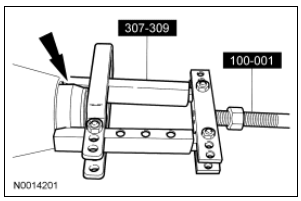
3. Remove and discard the nut.



4. Using the special tool, remove the output shaft flange.



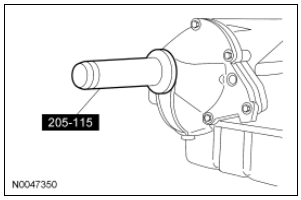
5. Using the special tools, remove and discard the extension housing seal.



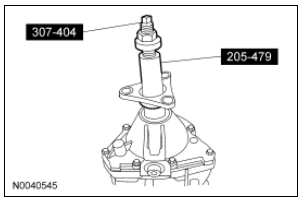
Installation

1. **NOTE:** Make sure the extension housing seal is correctly installed onto the special tool and the garter spring is in the correct position.

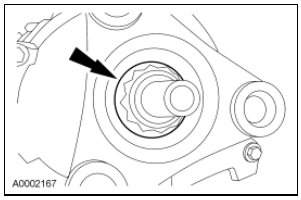
   Using the special tool, install the new extension housing seal.



2. Using the special tools, install the output flange.



3. Install a new nut.
   - Tighten to 131 Nm (97 lb-ft).



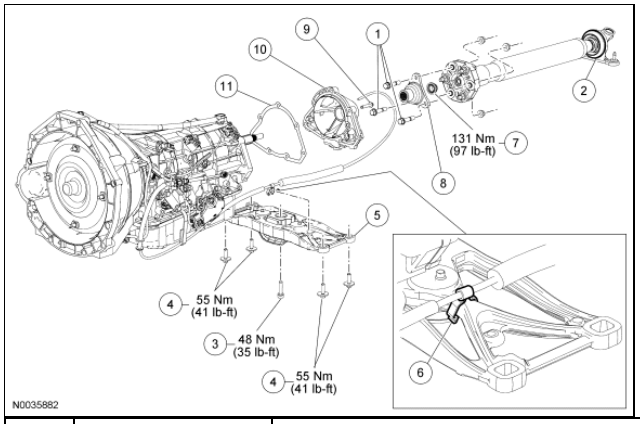
4. Install the driveshaft. For additional information, refer to Section 205-01 .

5. Check the transmission fluid level. For additional information, refer to Transmission Fluid Level Check in this section.

Extension Housing Gasket

Special Tool(s)

ST2440-A	Installer, Drive Pinion Flange 205-479
ST2416-A	Installer, Output Shaft Flange 307-404
ST2937A	Remover, Output Shaft Flange 307-523



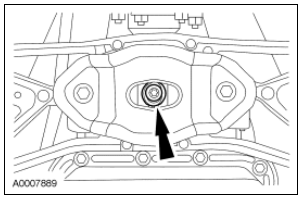
Item	Part Number	Description
1	W701357-S309	Output shaft flange coupler bolts
2	4602	Driveshaft
3	W705966-S426	Transmission insulator-to-extension housing center screw
4	W704971-S426	Transmission crossmember-to-floor pan screws
5	6A023	Transmission crossmember
6	7E395	Shift cable
7	W701357	Transmission output shaft flange nut
8	7089	Transmission output shaft flange
9	W500311-S437	Extension housing screws
10	7A039	Extension housing
11	7086	Extension housing gasket

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

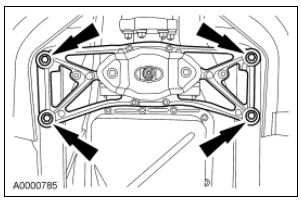
2. Remove the driveshaft. For additional information, refer to Section 205-01 .

3. Remove the transmission insulator-to-extension housing center screw.

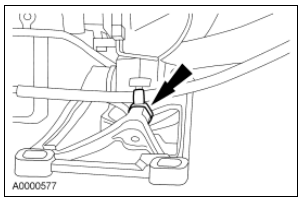


4. **NOTE:** Use a suitable transmission jack to support the transmission.

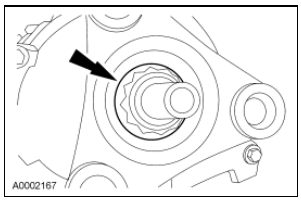
   Remove the 4 rear transmission crossmember-to-floor pan screws.



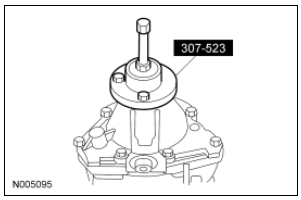
5. Disconnect the shift cable retainer and position the cable aside.



6. Remove and discard the nut.

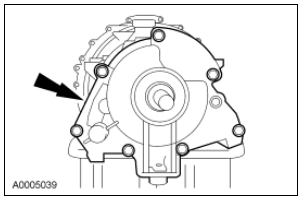


7. Using the special tool, remove the output shaft flange.

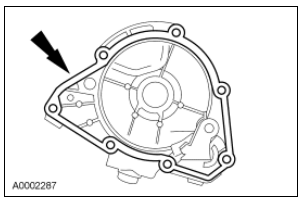


8. ⚠ **CAUTION: The parking pawl, parking pawl return and parking pawl shaft could fall out during removal of the extension housing.**

   Remove the 7 extension housing screws and the extension housing.



9. Remove and discard the extension housing gasket.



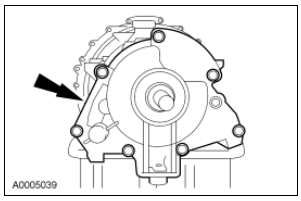
Installation

1. Clean the extension housing and install a new extension housing gasket. Make sure the park pawl is installed correctly.

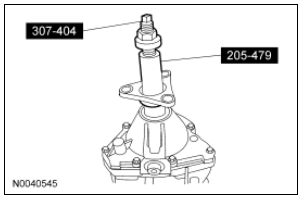
2. ⚠ **CAUTION: Make sure the parking lever actuating rod is correctly seated into the case parking rod guide cup.**

   Install the extension housing and screws.

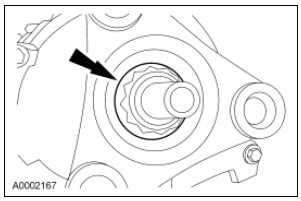
   - Tighten to 30 Nm (22 lb-ft).



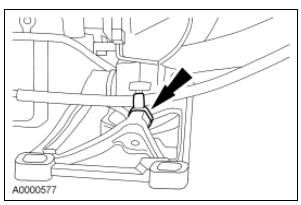
3. Using the special tools, install the output flange.



4. Install a new nut.
   - Tighten to 131 Nm (97 lb-ft).

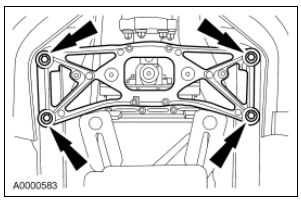


5. Install the shift cable retainer.

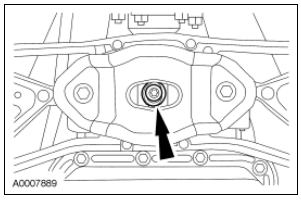


6. Install the transmission crossmember-to-floor pan screws.

- Tighten to 55 Nm (41 lb-ft).



7. Install the transmission insulator-to-extension housing center screw.
   - Tighten to 48 Nm (35 lb-ft).



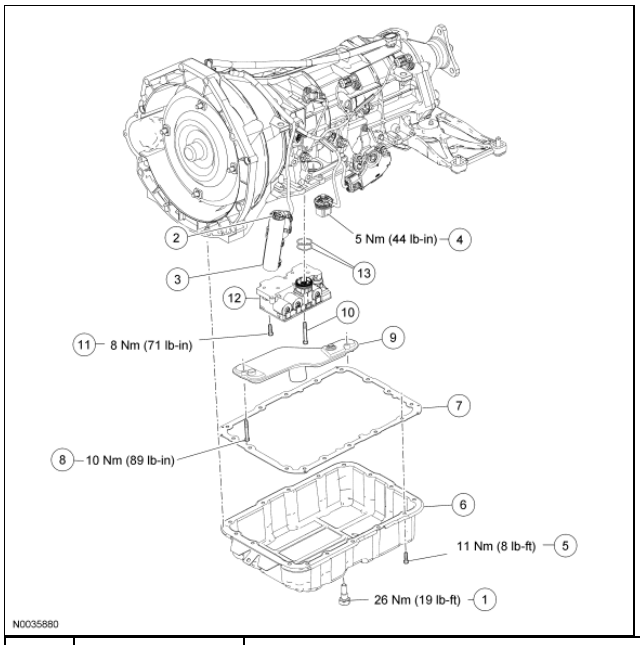
8. Install the driveshaft. For additional information, refer to Section 205-01 .

9. Check the transmission fluid level. For additional information, refer to Transmission Fluid Level Check in this section.

Solenoid Body Assembly

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

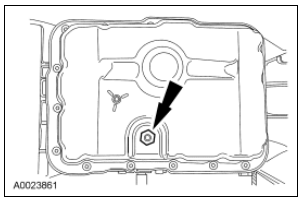


Item	Part Number	Description
1	7A010	Transmission fluid pan drain plug
2	—	Heated oxygen sensor (HO2S) electrical connector (part of 9F472)
3	—	HO2S electrical connector retainer
4	7E395	Solenoid body harness electrical connector
5	W500213	Transmission fluid pan screws
6	7A194	Transmission fluid pan
7	7A191	Transmission fluid pan gasket
8	W70559	Transmission fluid pan filter screws
9	7A098	Transmission fluid pan filter
10	W703189	Solenoid body screw
11	W702921	Solenoid body screw
12	7G391	Solenoid body
13	W705928	Solenoid body O-ring seals

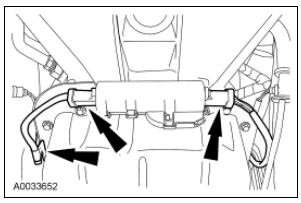
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

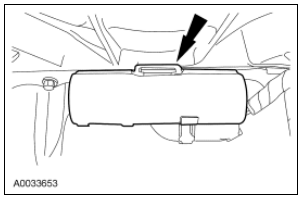
2. Remove the transmission fluid pan drain plug and drain the transmission.



3. Disconnect the heated oxygen sensor (HO2S) connectors and retaining clip from the RH pan rail and then position the connectors aside.

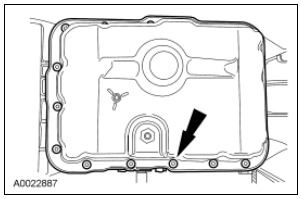


4. Remove the HO2S connector from the front of the transmission pan rail.



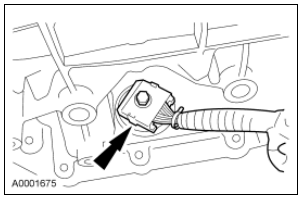
5. **NOTE:** The transmission fluid pan gasket is reusable; clean and inspect for damage. If not damaged, the gasket should be reused.

   Remove the transmission fluid pan screws, gasket and fluid pan.

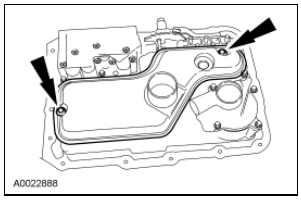


6. **NOTE:** Clean the area around the solenoid body connector to prevent contamination.

   Disconnect the solenoid body harness electrical connector.

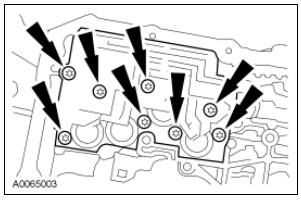


7. Remove the screws and the transmission fluid filter.



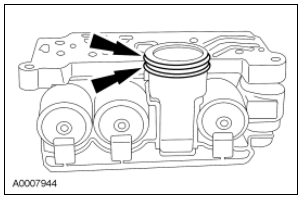
8. ⚠ **CAUTION: Do not damage the solenoid body connector pins.**

   Remove the solenoid body screws and remove the solenoid body by lifting on the body and pushing the connector from the other side of the case.



Installation

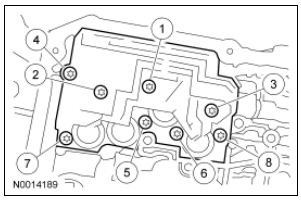
1. Install new O-ring seals on the solenoid body connector. Lubricate the O-ring seals with clean automatic transmission fluid.



2. ⚠ **CAUTION: Inspect the transmission case bore to make sure it is free of foreign material and not damaged. If it is damaged, transmission leaks may occur.**

   Install the solenoid body. Tighten the screws in the sequence shown.

   - Tighten to 8 Nm (71 lb-in).

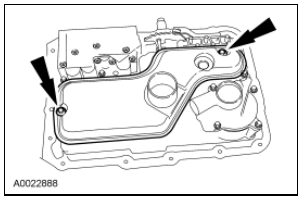


3. ⚠ **CAUTION: Lubricate the fluid filter seals with clean automatic transmission fluid or they may be damaged.**

   NOTE: Make sure the fluid filter seals are correctly seated on the filter.

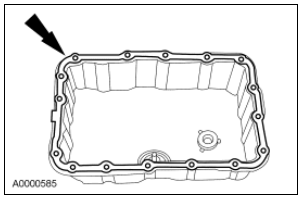
   Lubricate the seals and install the transmission fluid filter.

   - Tighten to 10 Nm (89 lb-in).

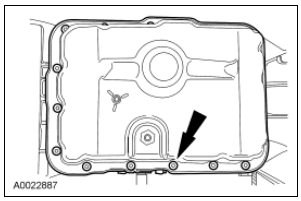


4. **NOTE:** The transmission fluid pan gasket is reusable; clean and inspect for damage. If not damaged, the gasket should be reused.

   Install the transmission fluid pan and gasket and loosely install the screws.



5. Tighten the screws in a crisscross sequence.
   - Tighten to 11 Nm (8 lb-ft).



6. ⚠ **CAUTION: Damage will occur to the solenoid body assembly if the screw is tightened above specification.**

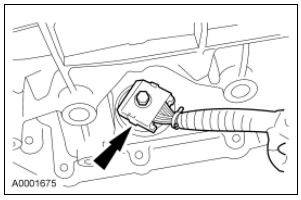
   NOTE: Always install new O-ring seals on the vehicle harness connector.

   NOTE: Clean the area around the connector to prevent contamination of the solenoid body connector.

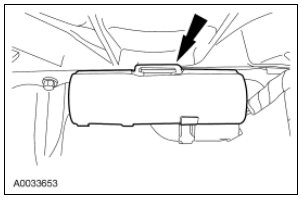
   NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

   Install and lubricate new O-ring seals on the transmission connector and connect the connector.

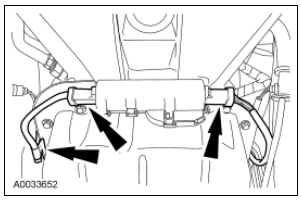
   - Tighten to 5 Nm (44 lb-in).



7. Install the HO2S connector from the front of the transmission pan rail.



8. Connect the HO2S connector and install the sensor wire retaining clip to the RH side of the transmission pan rail.

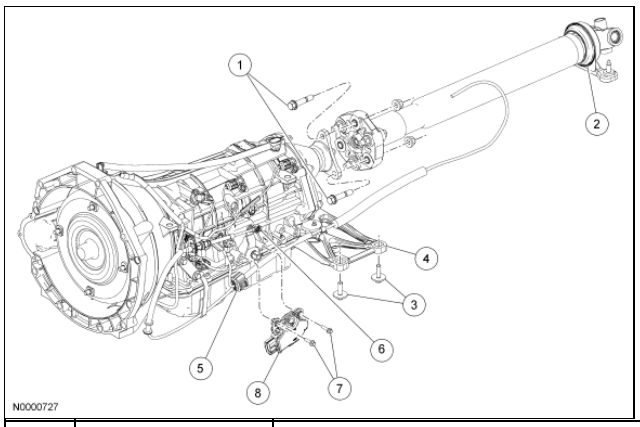


9. Fill the transmission. For additional information, refer to Transmission Fluid Drain and Refill — Automated Equipment or Transmission Fluid Level Check in this section.

Digital Transmission Range (TR) Sensor

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)



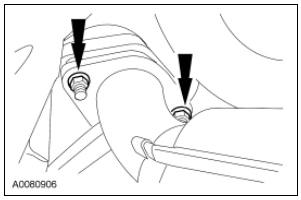
Item	Part Number	Description
1	W701357-S309	Output shaft flange couplers
2	4817	Driveshaft
3	W704971-S426	Transmission support screws
4	6A023	Transmission support
5	14A646	Transmission range (TR) sensor electrical connector
6	7E395	Transmission selector lever cable
7	W500015-S437	TR sensor screws
8	7F293	TR sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the driveshaft. For additional information, refer to Section 205-01 .

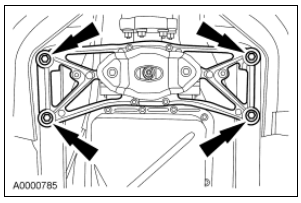
3. Loosen the 4 converter-to-manifold nuts.



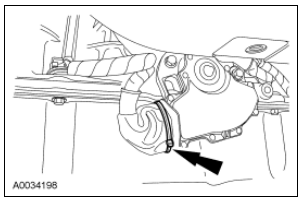
4. ⚠ **WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions may result in personal injury.**

Using a suitable transmission jack, support the transmission.

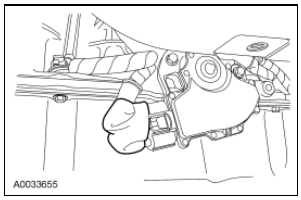
5. Remove the transmission crossmember-to-floor pan screws and lower the transmission enough to gain access to the TR sensor.



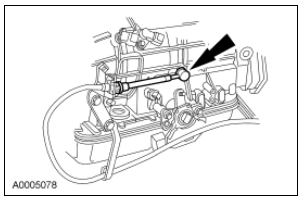
6. Remove and discard the tie strap from the digital TR sensor connector boot.



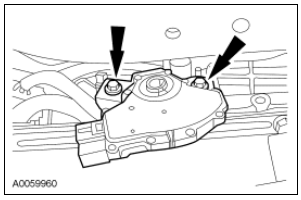
7. Slide the rubber boot back and disconnect the digital TR sensor connector.



8. Disconnect the transmission shift cable from the manual control lever.



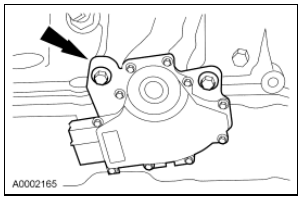
9. Remove the digital TR sensor screws and remove the digital TR sensor.



Installation

1. ⚠ **CAUTION: The digital TR sensor must fit flush against the boss on the case to prevent damage to the sensor.**

   Install the digital TR sensor and loosely install the screws.

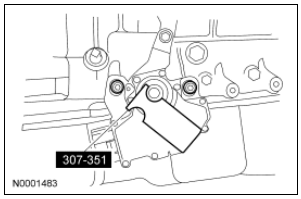


2. ⚠ **CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.**

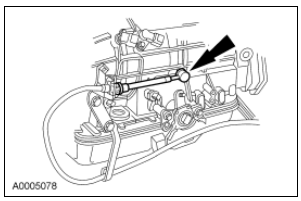
   NOTE: The manual lever must be in the NEUTRAL position.

   Using the special tool, align the digital TR sensor and tighten the screws in an alternating sequence.

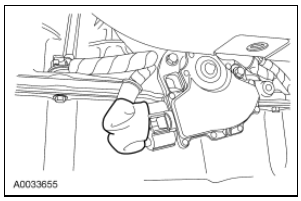
   - Tighten to 8 Nm (71 lb-in).



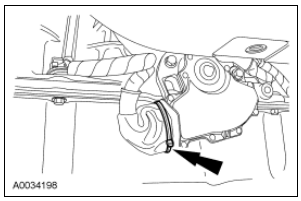
3. Connect the transmission shift cable from the manual control lever.



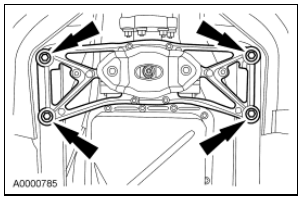
4. Connect the digital TR sensor connector and slide the rubber boot back.



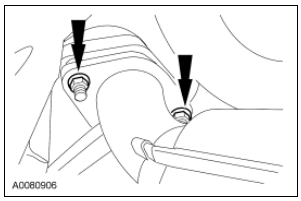
5. Install a tie strap on the digital TR sensor connector boot.



6. Install the transmission crossmember-to-floor pan screws.
   - Tighten to 55 Nm (41 lb-ft).



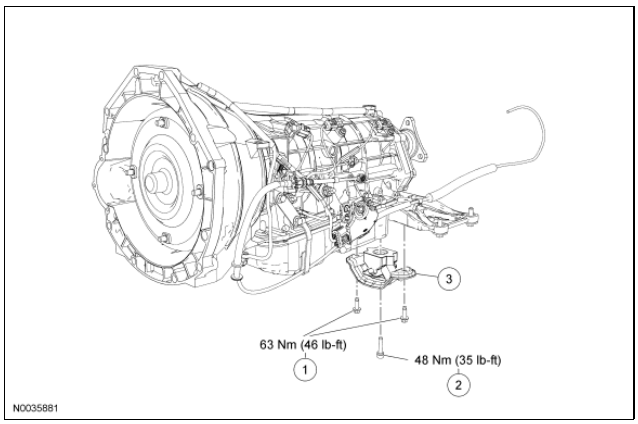
7. Tighten the 4 converter-to-manifold nuts.
    - Tighten to 40 Nm (30 lb-ft).



8. Install the driveshaft. For additional information, refer to Section 205-01 .

9. Verify that the shift cable is adjusted correctly. For additional information, refer to Section 307-05 .

Transmission Support Insulator



Item	Part Number	Description
1	W704971-S426	Transmission crossmember-to-floor pan screws
2	W705966-S426	Transmission insulator-to-extension housing center screw
3	6038B	Rear transmission crossmember

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Support the transmission with a transmission jack.

3. Remove the rear transmission crossmember-to-floor pan screws.
   - To install, tighten to 63 Nm (46 lb-ft).

4. Remove the transmission insulator-to-extension housing center screws.
   - To install, tighten to 48 Nm (35 lb-ft).

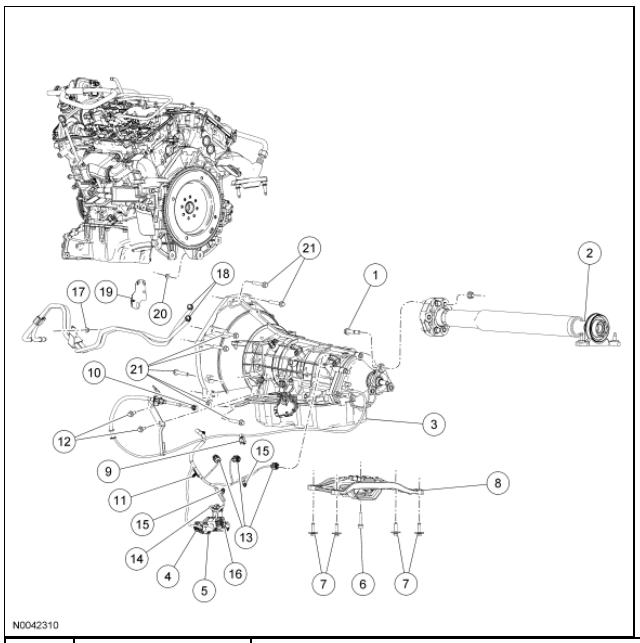
5. Remove the rear transmission crossmember.

6. To install, reverse the removal procedure.

Transmission

Special Tool(s)

ST1636-A	Retainer, Torque Convertor 307-346 (T97T-7902-A)



Item	Part Number	Description
1	W701357	Transmission output shaft flange coupler bolts and nuts
2	4817	Driveshaft
3	7000	Transmission assembly
4	9F472	Heated oxygen sensor electrical connector
5	9F472	Heated oxygen sensor electrical connector retainer
6	W705966	Transmission insulator-to-extension housing center screw
7	W704971	Transmission crossmember-to-floor pan screws
8	6A023	Transmission crossmember
9	7E395	Cable retainer
10	7E395	Transmission selector lever cable eyelet
11	—	Wire harness retainer
12	7B229	Transmission selector lever cable screws and bracket
13	14A464	Speed sensor connector
14	7C078	Solenoid body harness electrical connector
15	14A464	Wire harness retainers
16	14A646	Transmission range TR sensor electrical connector

17	7A030	Fluid cooler tube bracket
18	7A030	Fluid cooler tube nuts
19	6C070	Torque converter access cover
20	N800750	Torque converter nuts
21	W500120	Transmission to engine screws

⚠ WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions can result in personal injury.

NOTE: When the battery has been disconnected and reconnected, some abnormal drive symptoms can occur while the vehicle relearns its adaptive strategy. The customer needs to be notified that they can experience slightly different upshifts (either soft or firm) and that this is a temporary condition and will eventually return to normal operating condition.

NOTE: If transmission disassembly or installation of a new transmission is necessary, drain the transmission fluid. Install the drain plug when finished.

NOTE: If the transmission is to be removed for an extended period of time, support the engine with a safety stand and a wood block.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

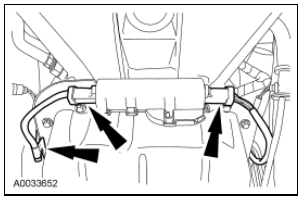
3. Remove the complete exhaust system and front heat shields. For additional information, refer to Section 309-00 .

4. Remove the driveshaft. For additional information, refer to Section 205-01 .

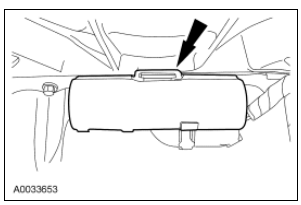
5. **⚠ WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions may result in personal injury.**

   Using a suitable transmission jack, support the transmission.

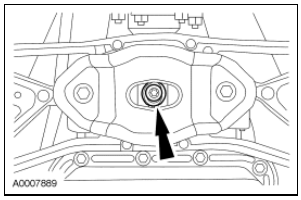
6. Disconnect the heated oxygen sensor (HO2S) connectors and retaining clip from the RH pan rail and then position the connectors aside.



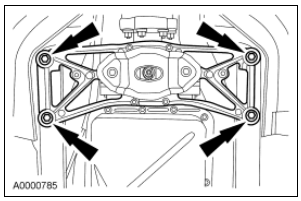
7. Remove the HO2S connector from the front of the transmission pan rail.



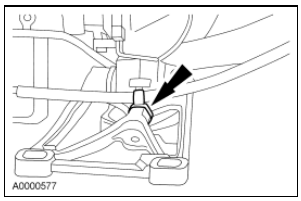
8. Remove the transmission insulator-to-extension center screw.



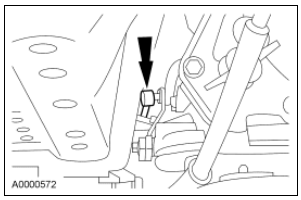
9. Remove the transmission crossmember-to-floor pan screws and remove the transmission crossmember.



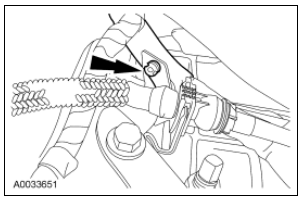
10. Disconnect the transmission shift cable retainer and position it aside.



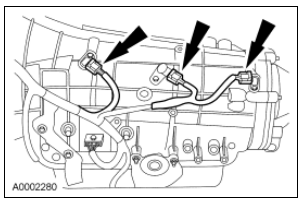
11. Disconnect the transmission shift cable eyelet from the manual lever.



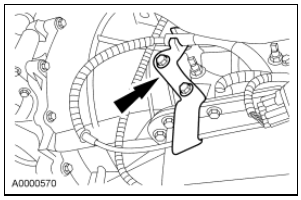
12. Disconnect the wire harness from the top of the transmission shift cable bracket.



13. Lower the transmission enough to gain access to the sensors. Disconnect the turbine shaft speed (TSS) sensor, output shaft speed (OSS) sensor and intermediate shaft speed sensor electrical connectors.

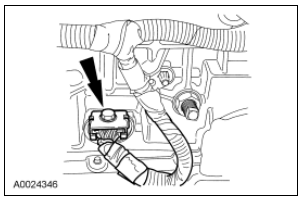


14. Remove the transmission shift cable bracket screws and bracket.

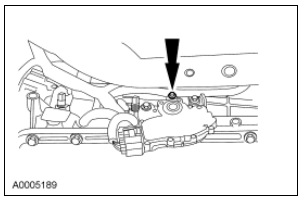


15. **NOTE:** Clean the area around connector to prevent contamination of the solenoid body connector.

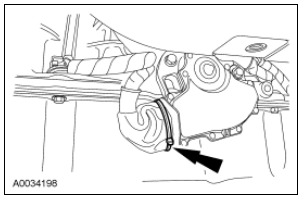
    Remove the screw from the solenoid body connector and disconnect the connector.



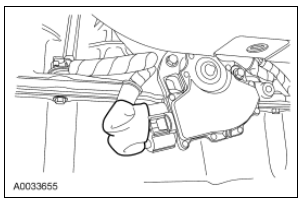
16. Disconnect the wire harness retainers.



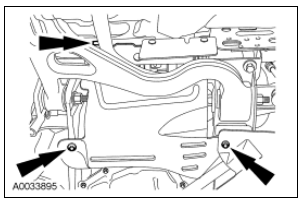
17. Remove and discard the tie strap from the digital transmission range (TR) sensor connector boot.



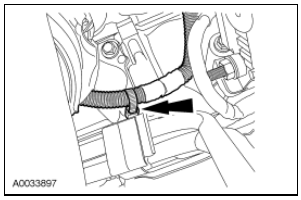
18. Slide the rubber boot back and disconnect the digital TR sensor connector.



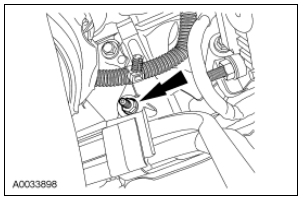
19. Remove the screws and pushpins, then remove the splash shield.



20. Disconnect the wire harness from the cooler line bracket.

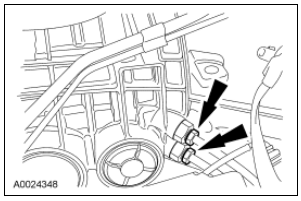


21. Disconnect the transmission cooler line bracket.

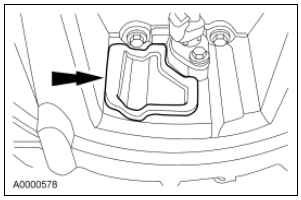


22. ⚠ **CAUTION: Do not damage the cooler tubes. Hold the transmission case fittings with a wrench.**

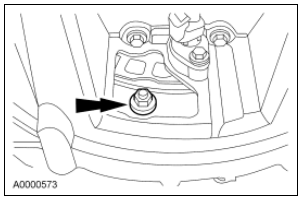
    Disconnect the transmission cooler tubes.



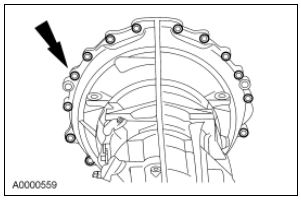
23. Remove the access cover.



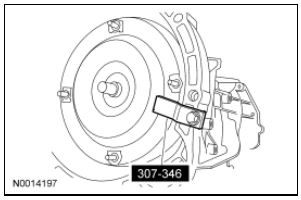
24. Remove the torque converter nuts.



25. Remove the transmission-to-engine screws.



26. Move the transmission back enough to install the special tool.

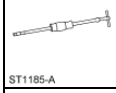
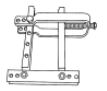
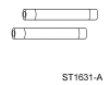


27. Carefully lower the transmission from the vehicle.

28. Make sure the transmission fluid cooler and cooler lines are cleaned at this time.
    - Carry out the Transmission Fluid Cooler — Backflushing and Cleaning procedure if the transmission is being overhauled, or if installing a new or remanufactured transmission. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.

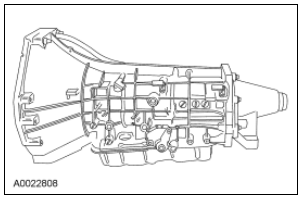
Transmission

Special Tool(s)

ST2417-A	Remover, Input Shaft Oil Seal 308-375
ST2418-A	Remover, Transmission Fluid Pump 307-397
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1758-A	Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)
ST2393-A	Compressor, Servo Cover 307-402
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
ST2937A	Remover, Output Shaft Flange 307-523

1. **NOTE:** Tag and identify all parts for reassembly.

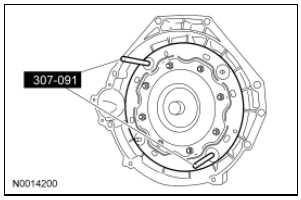
   Place the transmission on a bench.


A0022806

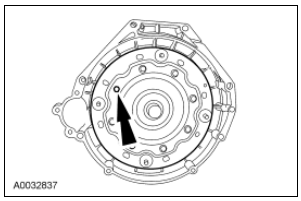
2. ⚠ **WARNING: The torque converter is heavy, especially when full of fluid.**

   NOTE: If not installing a new torque converter, leave the adapter plate screwed to the torque converter.

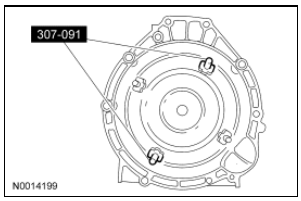
   Using the special tools, remove the torque converter and adapter plate as an assembly.



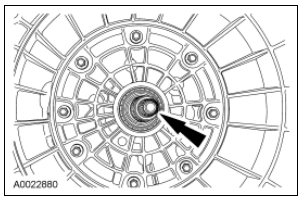
3. If the vehicle is equipped, and installation of a new or remanufactured torque converter is necessary, remove the torque converter adapter plate.



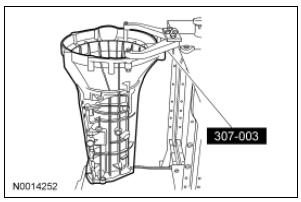
4. If the adapter plate has been removed, use the special tools to remove the torque converter.



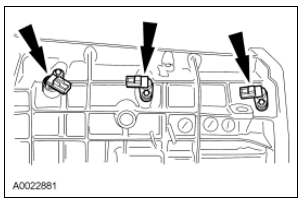
5. Remove the input shaft.



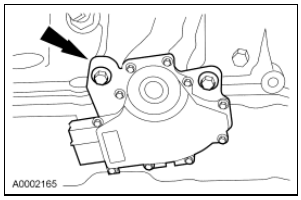
6. Using the special tool, install the transmission into the bench with the torque converter housing facing up.



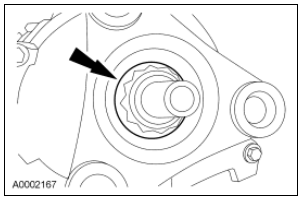
7. Remove the transmission sensors.



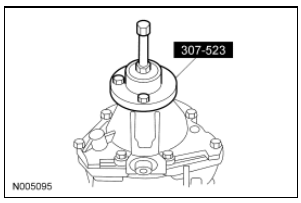
8. Remove the transmission range (TR) sensor.



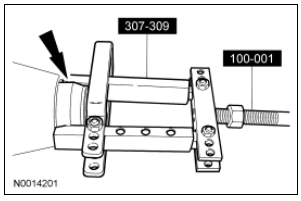
9. Remove and discard the nut.



10. Using the special tool, remove the output shaft flange.

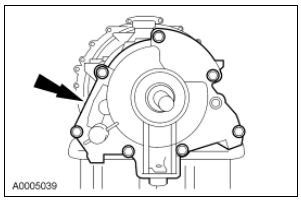


11. Using the special tools, remove the extension housing seal.

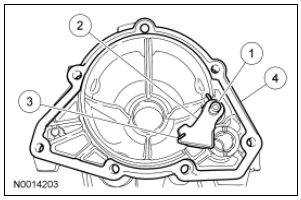


12. ⚠ **CAUTION: The parking pawl, parking pawl return spring and parking pawl shaft could fall out during removal of the extension housing.**

    Remove the extension housing.

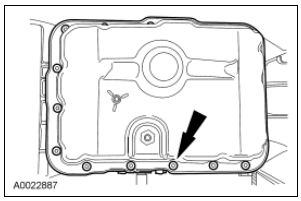


13. Remove the parking pawl assembly and discard the gasket.
    1. Remove the parking pawl shaft.
    2. Remove the parking pawl.
    3. Remove the parking pawl return spring.
    4. Remove and discard the gasket.

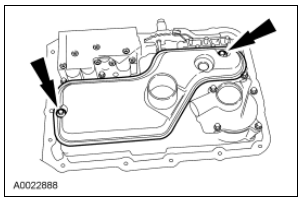


14. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect the gasket for damage. If the gasket is not damaged, the gasket should be reused.

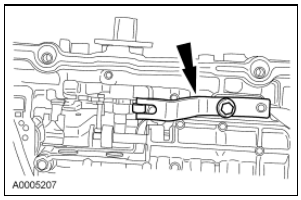
    Remove the 16 transmission fluid pan screws, transmission fluid pan and gasket.



15. Remove the transmission fluid filter and discard.

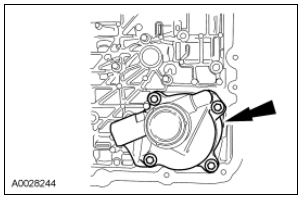


16. Remove the manual control valve detent spring.



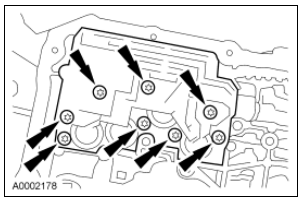
17. ⚠ **WARNING: The upper and lower servo covers are under spring tension. Use care when removing the piston and cover assembly. Failure to follow these instructions may result in personal injury.**

    Remove the reverse servo assembly.

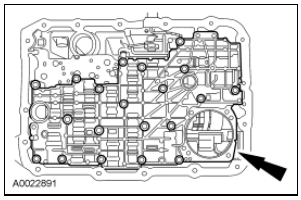


18. ⚠ **CAUTION: Do not damage solenoid body connector pins.**

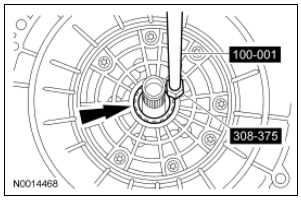
    Remove the solenoid body assembly by lifting on the body and pushing the connector from the other side of the case.



19. Remove the main control valve body, separator plate and gasket.



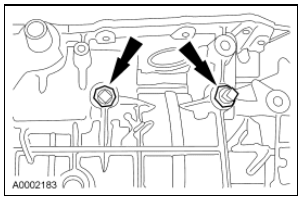
20. Using the special tools, remove the converter hub seal.



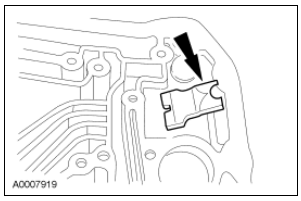
21. ⚠ **CAUTION: Failure to loosen the overdrive band adjusting screw prior to pump removal may cause damage to the pump and overdrive band.**

    ⚠ **CAUTION: Throw the locknuts away. The locknuts are not reusable for assembly.**

    Remove and discard the locknuts, and loosen the overdrive and intermediate band adjusting screw.

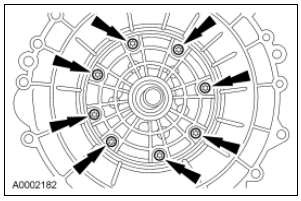


22. Remove and tag part for assembly.

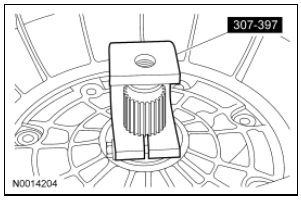


23. ⚠ **CAUTION: The screws are not reusable for assembly. Discard the screws. If the screws are reused, the housing may become separated from the transmission.**

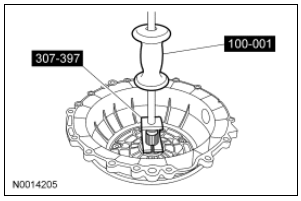
    Remove and discard the screws.



24. Install the special tool.

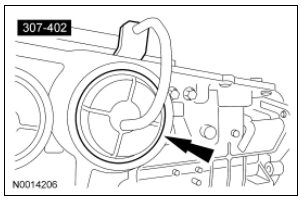


25. Using the special tools, remove the pump.

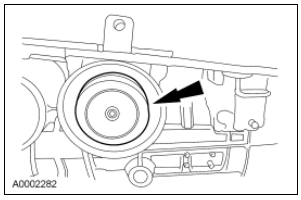


26. ⚠ **CAUTION: Servo cover is under spring tension.**

Using the special tool, remove the intermediate servo cover retaining ring.

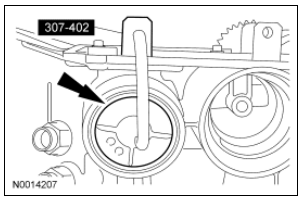


27. Remove the intermediate band servo piston and spring.

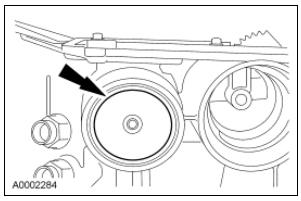


28. ⚠ **CAUTION: Servo cover is under spring tension.**

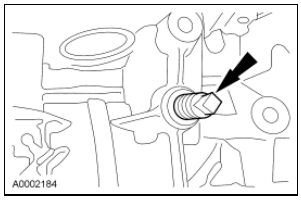
Using the special tool, remove the overdrive servo cover retaining ring and cover.



29. Remove the front band servo piston and spring.

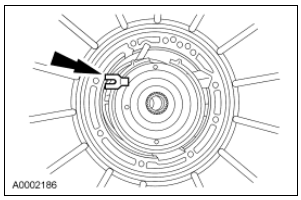


30. Remove the screw.



31. **NOTE:** Tag and identify parts for reassembly.

    Compress the overdrive band and remove the apply strut.

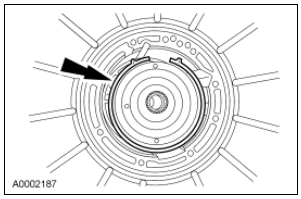


32. ⚠ **CAUTION: Identify the anchor and apply ends of the overdrive band.**

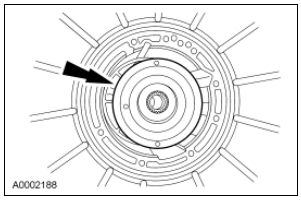
    NOTE: The new overdrive band is dark in color. This is a normal condition of the band. Hairline cracks in the band are also considered normal. Do not install a new band based solely on the color.

    Remove and inspect the overdrive band. Check the following conditions when installing a new band:

    - Inspect for glazing.
    - Inspect for missing friction material.
    - Inspect for material flaking.
    - Inspect for damage to the anchor pins.



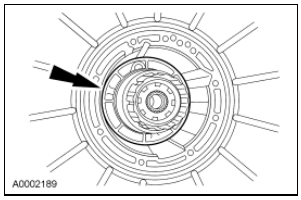
33. Remove the overdrive brake and coast clutch drum.



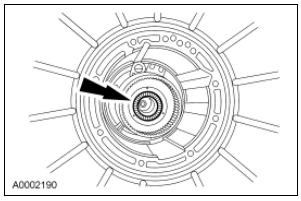
34. ⚠ **CAUTION: Do not bend the trigger wheel.**

    NOTE: The No. 12 thrust bearing is in this assembly.

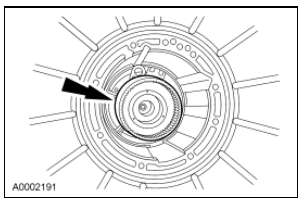
    Remove the planetary gear overdrive carrier.



35. Remove the No. 2 overdrive planet thrust bearing.

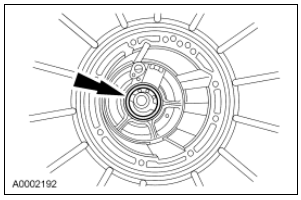


36. Remove the overdrive ring gear, overdrive one-way clutch assembly and center shaft as an assembly.



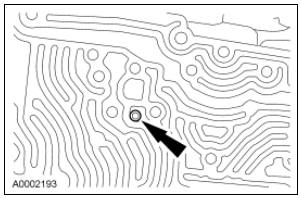
37. **NOTE:** Tag and identify the center shaft thrust bearing No. 3 for reassembly.

    Remove the No. 3 center shaft thrust bearing.

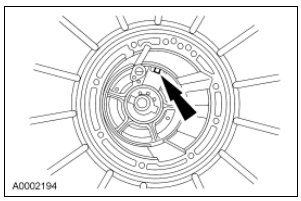


38. ⚠ **CAUTION: The center support locknut could fall into the remaining assembly if not removed.**

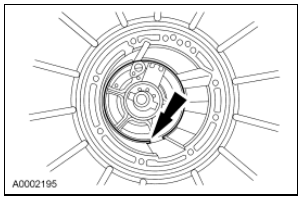
    Remove the bolt.



39. Remove the locknut and cage.



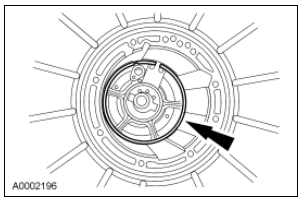
40. Remove the center support retaining ring.



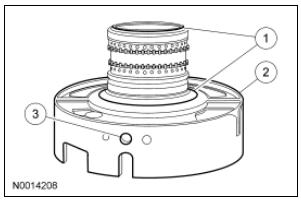
41. **NOTE:** The center support is repaired as an assembly. Any damage requires installing a new component.

    NOTE: When removing the center support, pull evenly around the center support web.

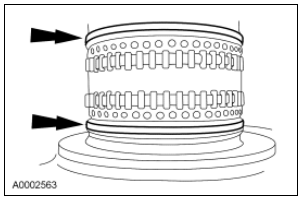
    Remove the center support.



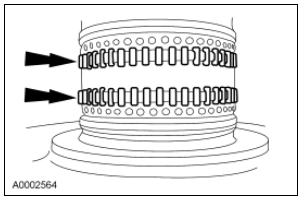
42. Inspect the center support assembly for wear or damage.
    1. Inspect the thrust surfaces for wear or damage.
    2. Inspect the center support sealing surface.
    3. Inspect the fluid passage for blockage or damage.



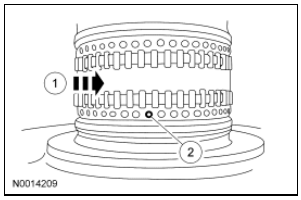
43. Inspect the seal rings for damage.



44. Inspect the bearing for missing rollers or damage.

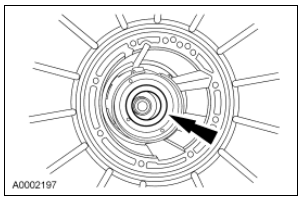


45. Inspect the direct clutch feed hole for blockage or damage.
    1. Rotate the center support bearing to locate the direct clutch feed hole.
    2. Inspect the direct clutch feed hole for blockage or damage.

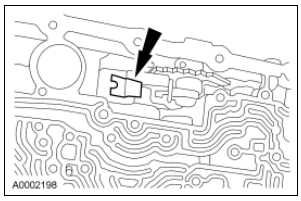


46. **NOTE:** Tag and identify the No. 4 intermediate clutch drum thrust bearing.

    Remove the intermediate brake drum thrust bearing (No. 4).



47. Remove, tag and identify the band anchor strut for assembly.

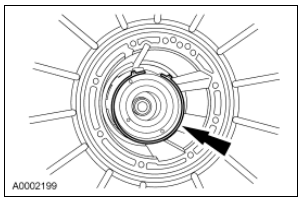


48. ⚠ **CAUTION: Identify the anchor and apply ends of the intermediate band.**

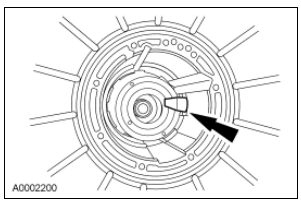
    NOTE: The new intermediate band is dark in color. This is a normal condition of the band. Hairline cracks in the band are also considered normal. Do not install a new band based solely on the color.

    Remove and inspect the intermediate band. Check the following conditions when installing a new band:

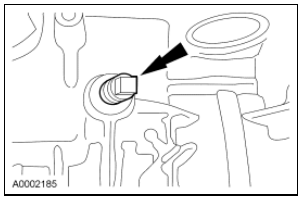
    - Inspect for glazing.
    - Inspect for missing friction material.
    - Inspect for material flaking.
    - Inspect for damage to the anchor pins.



49. Remove, tag and identify the band apply strut.

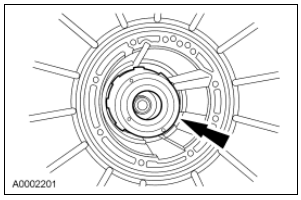


50. Remove the screw.

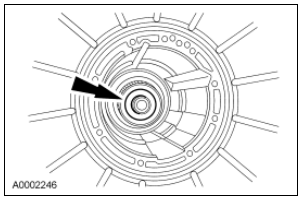


51. **NOTE:** The No. 5 forward clutch cylinder thrust bearing may come out with the intermediate brake and direct clutch drum.

    Remove the direct clutch drum.

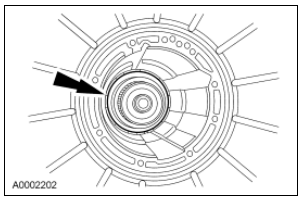


52. Remove the No. 5 forward clutch cylinder thrust bearing, tag and identify.



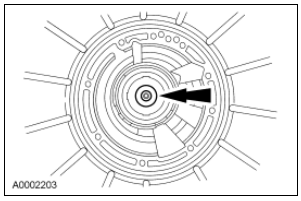
53. **NOTE:** The No. 6A thrust bearing may come out with the cylinder. Tag and identify for reassembly.

    Remove the forward clutch cylinder.



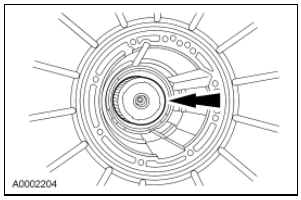
54. **NOTE:** The No. 6A forward ring gear hub thrust bearing may have come out with the forward clutch cylinder.

    Remove the No. 6A forward ring gear hub thrust bearing.

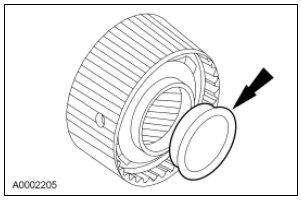


55. **NOTE:** The No. 7 forward planet thrust bearing may come out with the forward ring gear and hub assembly.

    Remove the forward ring gear and hub as an assembly.

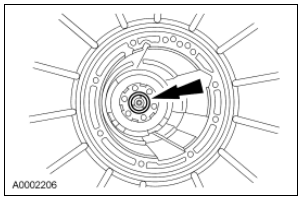


56. Remove the No. 6B forward clutch thrust washer from the forward ring gear hub.

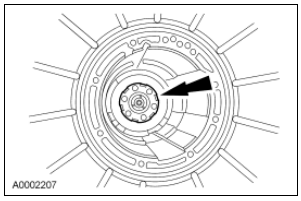


57. **NOTE:** The No. 7 forward planet thrust bearing may come out with the forward ring gear and hub assembly.

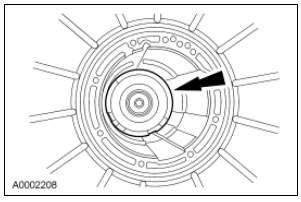
    Remove the No. 7 forward planet thrust bearing.



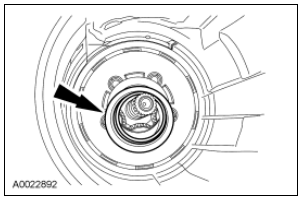
58. Remove the forward planetary assembly.



59. Remove the input shell and sun gear assembly.

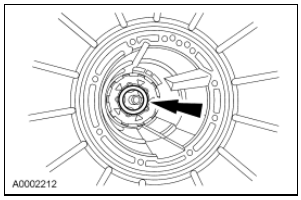


60. Remove the spacer.

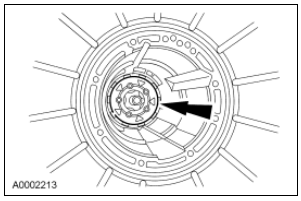


61. **NOTE:** Tag and identify the No. 8 low/reverse planetary carrier thrust bearing.

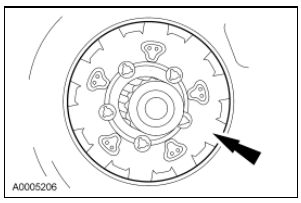
    Remove the thrust bearing.



62. Remove the retaining ring.

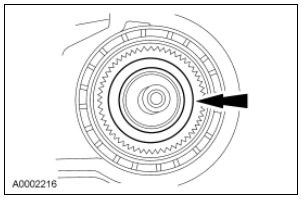


63. Remove the low/reverse planetary assembly.



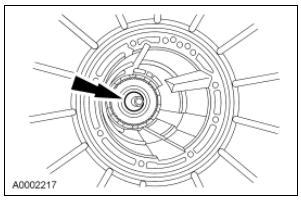
64. **NOTE:** Tag and identify the No. 9 low/reverse planetary carrier thrust bearing.

    Remove the thrust bearing.



65. **NOTE:** Use slots located around the outside of the sleeve.

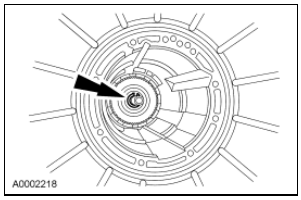
    Using a small pick, remove the output shaft sleeve.



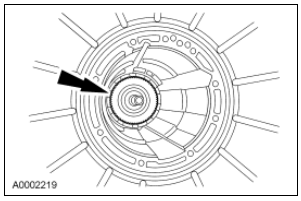
66. **⚠ WARNING: The output shaft may fall out after removing the snap ring. Failure to follow these instructions may result in personal injury.**

    ⚠ CAUTION: Discard the output shaft retaining ring. A new retaining ring must be used for assembly.

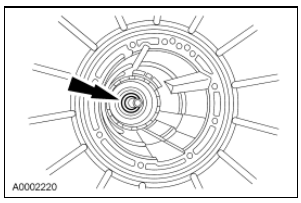
    While holding the output shaft, remove and discard the output shaft retaining ring.



67. Remove the output shaft ring gear and hub.



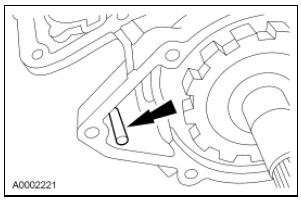
68. Remove the No. 10 low/intermediate sun gear bearing.



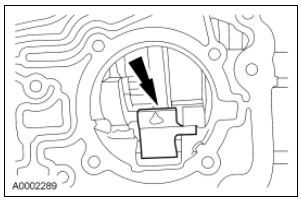
69. ⚠ **CAUTION: Do not pry on the outer edge of the case. Damage to the gasket sealing surface could occur.**

    NOTE: It may be necessary to grind flat spots on the edges of the reverse band actuating lever shaft in order to remove it.

    Using a pair of vice grips, hold the flat spots on the reverse band actuating lever shaft, wiggle it back and forth and remove the reverse band actuating lever shaft.

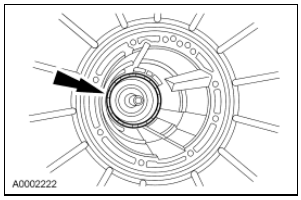


70. Remove the reverse band actuating lever assembly.



71. **NOTE:** The inner race of the rear one-way clutch is not removable. It is repaired in the case.

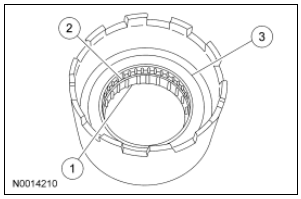
    Remove the low/reverse brake drum and one-way clutch assembly by rotating it clockwise.



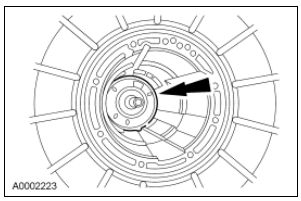
72. **NOTE:** The reverse one-way clutch is part of the reverse brake drum assembly. Install a new reverse brake drum as an assembly only.

    Inspect the reverse brake drum assembly and install a new reverse brake drum assembly if damaged.

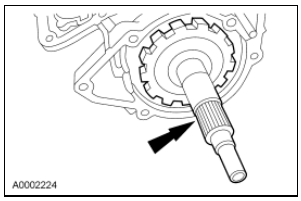
    1. Inspect the reverse brake drum sprags.
    2. Inspect the reverse brake drum rollers.
    3. Inspect the reverse brake drum.



73. Remove the reverse band.

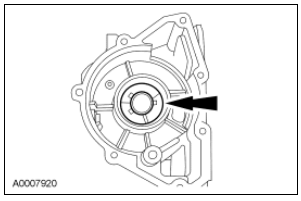


74. Remove the output shaft and park gear.



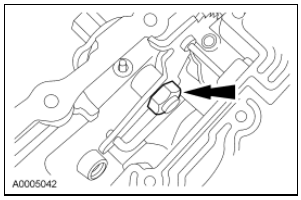
75. **NOTE:** Tag and identify the No. 11 output shaft thrust washer.

    Remove the output shaft thrust washer.

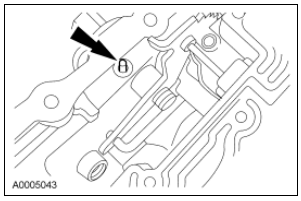


76. ⚠ **CAUTION: To avoid damage, make sure the wrench does not strike the manual valve inner lever pin.**

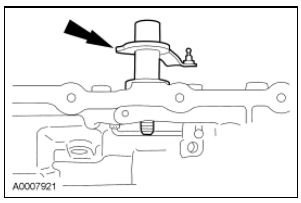
    Remove the nut.



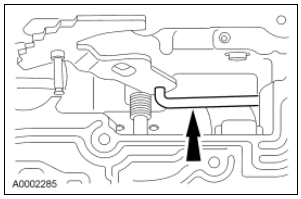
77. Remove the manual shaft retaining pin.



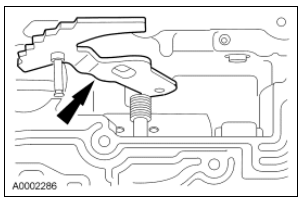
78. Remove the manual control lever shaft.



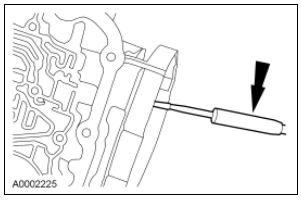
79. Disconnect the manual valve inner lever from the parking lever actuating rod.



80. Remove the manual valve inner lever.

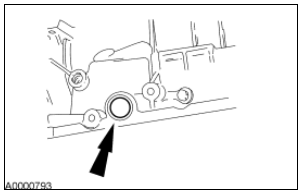


81. Remove the parking lever actuating rod.



82. ⚠ **CAUTION: Do not damage the bore.**

Remove the manual control lever seal.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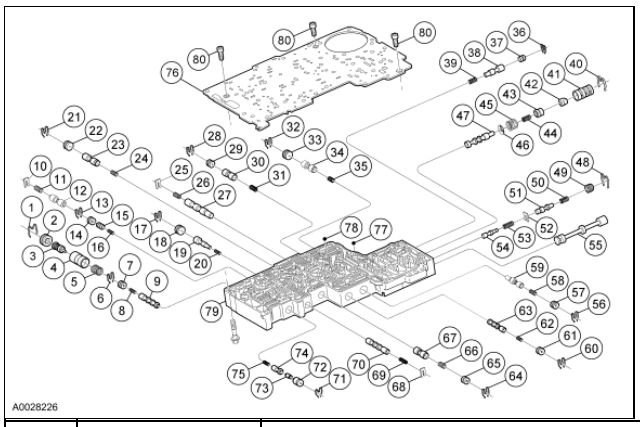
Main Control Valve Body

Special Tool(s)

ST1639-A	Aligner, Valve Body (2 required) 307-334 (T95L-70010-C)



Item	Part Number	Description
1	—	Clip — retainer
2	—	Plug — retainer
3	—	Valve assembly — thermo
4	—	Valve — fluid cooler bypass
5	—	Spring — fluid cooler bypass
6	—	Clip — retainer
7	—	Plug — retainer
8	—	Spring — converter clutch control valve
9	—	Valve — converter clutch control
10	—	Plate
11	—	Spring — coast clutch control
12	—	Valve — coast clutch control
13	—	Clip — retainer
14	—	Plug — retainer
15	—	Valve — converter clutch back pressure
16	—	Spring — converter clutch back pressure
17	—	Clip — retainer
18	—	Plug — retainer
19	—	Valve — VFS2 modulator
20	—	Spring — VFS2 modulator valve
21	—	Clip — retainer
22	—	Plug — retainer

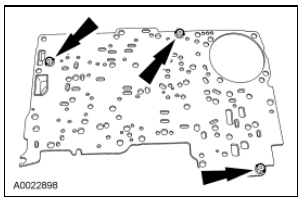
23	—	Valve — intermediate servo release
24	—	Spring — intermediate servo release valve
25	—	Plate
26	—	Spring — high clutch control
27	—	Valve — high clutch control
28	—	Plug — retainer
29	—	Clip — retainer
30	—	Valve — reverse modulator
31	—	Spring — reverse modulator valve
32	—	Clip — retainer
33	—	Plug — retainer
34	—	Valve — reverse engagement
35	—	Spring — reverse engagement valve
36	—	Clip — retainer
37	—	Plug — retainer
38	—	Valve — VFS1 modulator
39	—	Spring —VFS1 modulator valve
40	—	Clip — retainer
41	—	Sleeve
42	—	Valve — booster
43	—	Valve — booster
44	—	Spring — inner
45	—	Spring — outer
46	—	Spring — retainer
47	—	Valve — main regulator
48	—	Clip — retainer
49	—	Plug — retainer
50	—	Spring — converter limit
51	—	Valve — converter limit
52	—	Plate
53	—	Spring — solenoid regulator valve
54	—	Valve — solenoid regulator
55	—	Valve — manual
56	—	Clip — retainer
57	—	Plug — retainer
58	—	Spring — rear servo control valve
59	—	Valve — rear servo control
60	—	Clip — retainer
61	—	Plug — retainer
62	—	Spring — RS ISA select valve
63	—	Valve — RS ISA select
64	—	Clip — retainer
65	—	Plug — retainer
66	—	Spring — forward engagement control valve

67	—	Valve — forward engagement control
68	—	Plate
69	—	Spring — Overdrive (O/D) servo control
70	—	Valve — O/D servo control
71	—	Retainer — clip
72	—	Sleeve — converter clutch modulator control
73	—	Valve — converter clutch modulator control
74	—	Valve — converter clutch modulator
75	—	Spring — converter clutch modulator control
76	7Z490	Plate assembly — main control valve body separator
77	7E195	Ball — lubrication check
78	7E195	Ball — shuttle valve
79	7A101	Body — control valve lower
80	W701099	Screws — separator plate

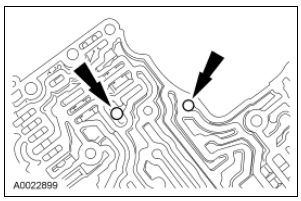
Disassembly

1. **NOTE:** The valve body separator plate has a bonded gasket. Do not reuse. Discard the plate.

   Remove and discard the valve body separator plate.



2. Remove the check balls.



3. **NOTE:** Refer to the disassembled view.

   Disassemble the main control valve body only if cleaning is required.

Assembly

1. ***NOTICE:*** **Do not lose parts when cleaning or repairing.**

   Thoroughly clean all parts in solvent and blow dry with moisture-free compressed air.

2. ***NOTICE:*** **Do not stone, file or sand the valves. This will remove the anodized finish and may result in further main control or transmission damage.**

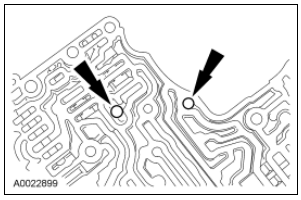
   After cleaning the main control valve body, carry out the following:

   - Inspect all valve and plug bores for scoring or burrs.

- Check all fluid passages for obstructions.
- Inspect all valves and plugs for burrs.
- Inspect all mating surfaces for burrs or distortion.
- Inspect all springs for distortion.
- Check all valves and plugs for free movement in their respective bores.
    - ♦ Valves and plugs, when dry, must fall from their own weight into their respective bores.
- Roll the manual valve on a flat surface to check for a bent condition.

3. Assemble the main control valve body.

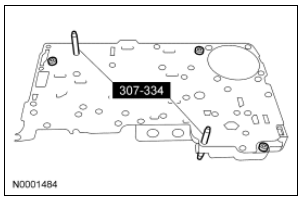
4. Install the main control valve body check balls.



5. **NOTE:** Use a new valve body separator plate for main control valve body installation.

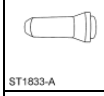
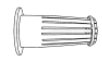
   Using the Valve Body Aligners, install a new main control valve body separator plate.

   - Tighten to 7 Nm (62 lb-in).



Fluid Pump

Special Tool(s)

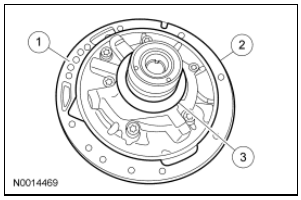
 ST1833-A	Installer, Torque Converter Fluid Seal 307-349 (T97T-77000-A)
ST1817-A	Alignment Set, Fluid Pump 307-S039 (T74P-77103-X)
ST2532-A	Aligner, Fluid Pump Handle 307-431
ST2533-A	Aligner, Fluid Pump Pilot 307-432
ST1826-A	Sizer, Piston Seal 307-338 (T95L-70010-G)
ST2419-A	Alignment Pins, Transmission Pump 307-398
ST2684-A	Transmission Fluid Pump Seal Aligner 307-451/1
ST2685-A	Transmission Fluid Pump Seal Sizer 307-451/2
 ST2686-A	Transmission Fluid Pump Seal Installer 307-451/3

Material

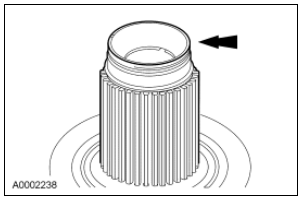
Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

Disassembly

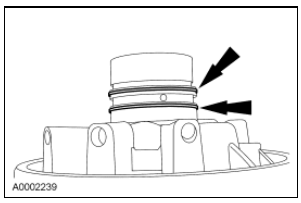
1. Remove the fluid pump gasket, fluid pump seal ring and the No. 1 thrust washer.
    1. Remove and discard the fluid pump gasket.
    2. Remove and discard the fluid pump seal ring (square cut).
    3. Remove and tag the No. 1 thrust washer.



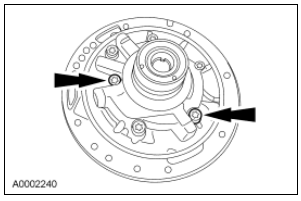
2. Remove the fluid pump support seal ring.



3. Remove the seal rings.



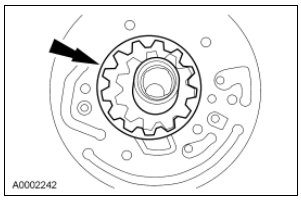
4. Remove the fluid pump housing.



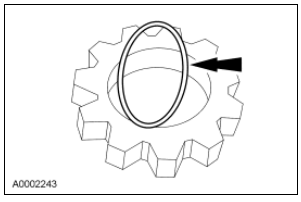
5. **NOTE:** A rough casting on the pump surface crescent is not a flaw.

   NOTE: The fluid pump gears are part of the pump assembly and are not repaired separately.

   Remove the fluid pump gears.

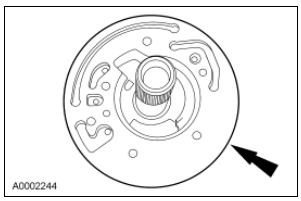


6. Remove the drive gear O-ring seal and discard. Inspect the fluid pump gears for cracks and scoring.

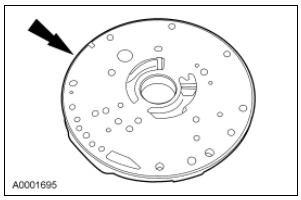


7. Inspect the overdrive pump.
   - Inspect the overdrive pump support gear pockets for scoring and wear.

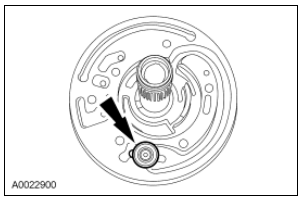
- Clean and inspect the overdrive and rear input shaft bushings.



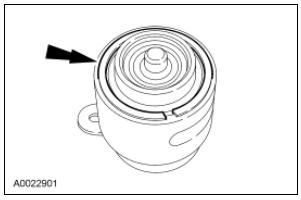
8. Inspect the fluid pump adapter plate for scoring and wear.



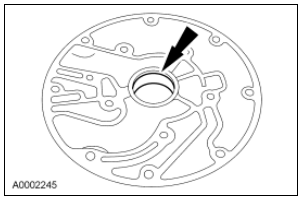
9. Remove the valve.



10. Remove and discard the seal.



11. Inspect the fluid pump to converter housing bushing.



Assembly

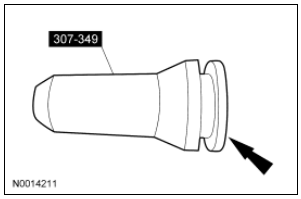
1. **NOTE:** Minor burrs and scoring may be removed with crocus cloth. If damage is found, install a new assembly.

   Inspect the fluid pump components for the following:

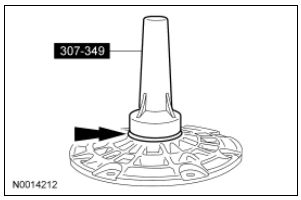
   - Pump body and case for burrs.
   - Fluid passages for obstructions.

2. **NOTE:** Check and make sure that the garter spring in the seal has not popped off of the converter hub seal.

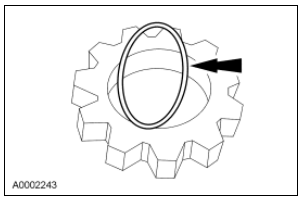
Install a new seal onto the special tool.



3. Using the special tool, install the converter hub seal.

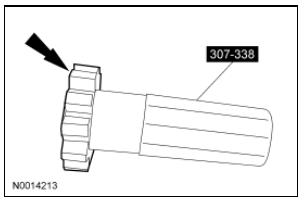


4. Install a new O-ring seal in the fluid pump drive gear.



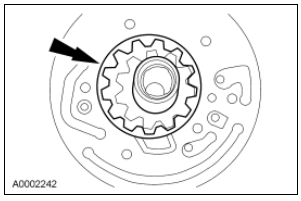
5. ⚠ **CAUTION: Lubricate the special tool with multi-purpose grease.**

   Using the special tool, seat the O-ring seal in the pump gear.

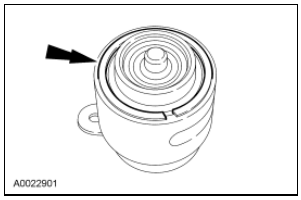


6. ⚠ **CAUTION: The chamber on the inside edge of the small gear must be UP when in the pump housing gear pocket. The dimple on the larger gear must be DOWN when in the pump housing gear pocket.**

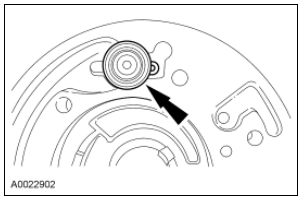
   Install the pump gears into the fluid pump housing. Apply multi-purpose grease to the pump gear to prevent scoring at start up.



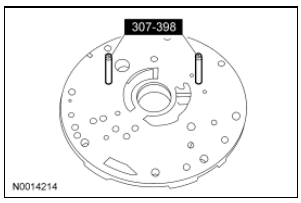
7. Install a new seal on the valve.



8. Install the valve with the tab facing down.

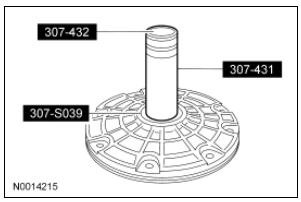


9. First, install the fluid pump adapter plate, then install the alignment pins in their correct location.

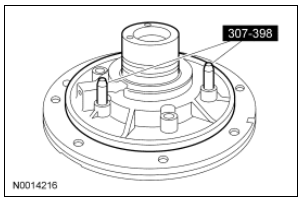


10. ⚠ **CAUTION: The special tools must be used to correctly align the pump with the adapter plate to reduce gear noise, bushing failure and leakage.**

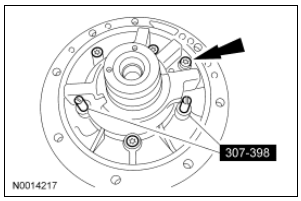
    Using the special tool, align the fluid pump to the adapter plate.



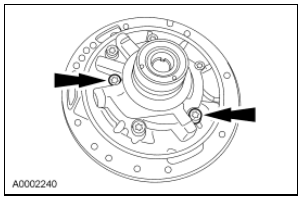
11. Using the special tools, assemble the pump.



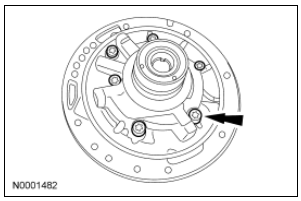
12. Loosely install the fluid pump housing screws in their correct location and remove the special tools.



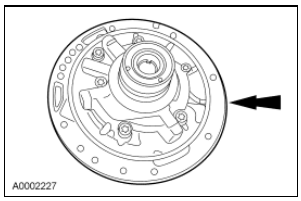
13. Install the 2 remaining screws.



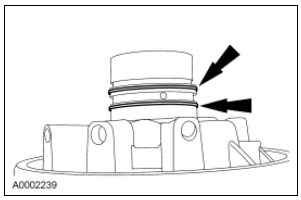
14. Tighten all of the fluid pump screws in a star pattern.
    - Tighten to 22 Nm (16 lb-ft).



15. Install a new fluid pump seal ring.

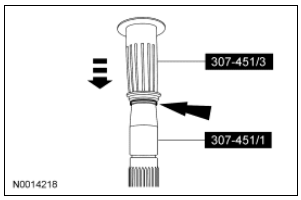


16. Install the 2 new seal rings.



17. ⚠ **CAUTION: Be careful not to overstretch the seal ring past the seal ring groove. Damage to the seal will occur.**

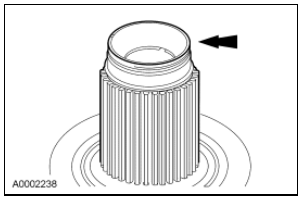
    Using the special tools, install the fluid pump seal ring.



18. ⚠ **CAUTION: Verify correct seal installation. Make sure seal grooves are clean and free of burrs.**

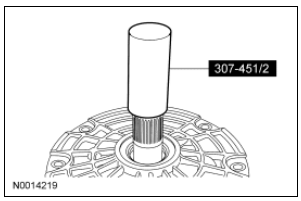
    NOTE: Make sure seal grooves are clean and free of burrs. Make sure that the seal is seated into the groove.

    Verify the seal is installed correctly.



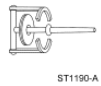
19. ⚠ **CAUTION: Failure to correctly size the seal will cause damage to the seal when the torque converter is installed.**

    Using the special tool, size the seal to the correct size. Leave the special tool on the seal ring for 2 minutes to obtain the correct seal size.



Overdrive Brake and Coast Clutch Drum Assembly

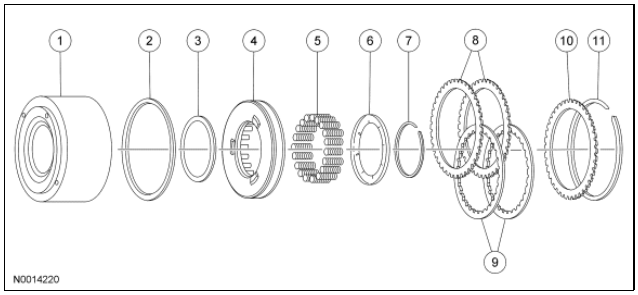
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
ST2431-A	Protector, Piston Seal 307-049 (T74P-77404-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Overdrive Brake and Coast Clutch Drum Assembly

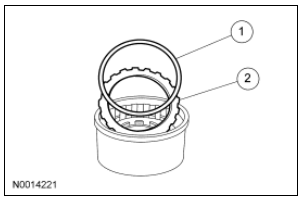


Item	Part Number	Description
1	7L669	Coast clutch drum
2	7A548	Overdrive piston outer seal ring
3	7D404	Overdrive piston inner seal ring
4	7A262	Overdrive clutch piston
5	7A480	Overdrive piston spring (20 required)
6	7A527	Coast clutch piston spring retainer
7	E860125-S	Retaining ring
8	7B442	Coast clutch external plate — steel (2 required)
9	7B164	Coast clutch internal plate — friction (2 required)
10	7B066	Coast clutch pressure plate
11	E860126S/129S	Retaining ring (select fit)

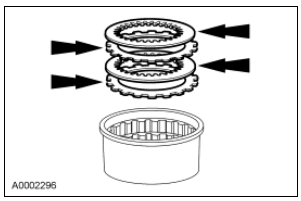
Disassembly

1. Remove the coast clutch pressure plate.

1. Remove the coast clutch retaining ring.
2. Remove the coast clutch pressure plate.



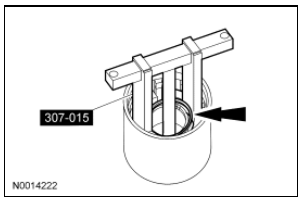
2. Remove the coast clutch disc pack.
    - Inspect for wear, install a new pack as necessary.



3. **⚠ WARNING: Use caution when releasing tool pressure on the rear clutch piston spring. Failure to follow these instructions may result in personal injury.**

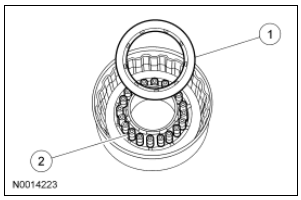
   ⚠ CAUTION: Do not fully compress the special tool or damage to the spring retainer may occur.

   Using the special tool, remove the coast clutch piston retaining ring.



4. Relieve the coast clutch spring tension and remove the special tool.

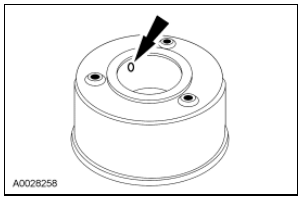
5. Remove the coast clutch piston springs.
    1. Remove the coast clutch piston retainer.
    2. Remove the clutch piston springs.



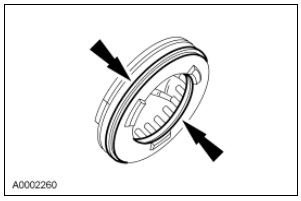
6. **⚠ WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air, and make sure the drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

   Remove the coast clutch piston.

    - Apply air pressure to the hole in the drum to remove the coast clutch piston while blocking the other hole with a finger.



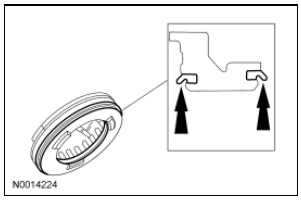
7. Remove and discard the coast clutch piston inner seal and the coast clutch piston outer seal.



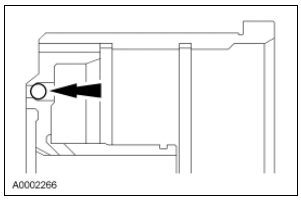
Assembly

1. ⚠ **CAUTION: The lip seals must be positioned as shown. Care must be taken to prevent rollover of the lip seal.**

   Install the new coast clutch piston inner and outer seal.



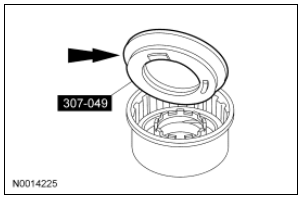
2. Verify the check ball is free to move.



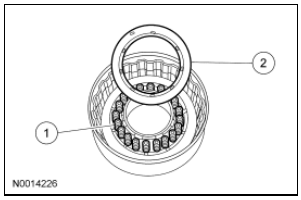
3. ⚠ **CAUTION: Care must be taken to prevent damage to the seals during installation.**

   Using the special tool, install the coast clutch piston.

   - Lubricate the seals with transmission fluid.

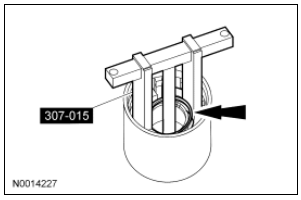


4. Install the coast clutch piston springs.
   1. Install the coast clutch piston springs.
   2. Install the coast clutch spring retainer.



5. **⚠ CAUTION: Do not fully compress the special tool or damage to the coast clutch piston spring retainer may occur.**

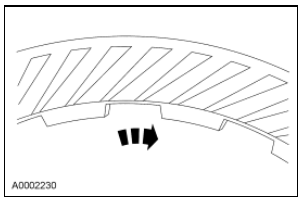
   Using the special tool, install the coast clutch piston spring retainer ring.



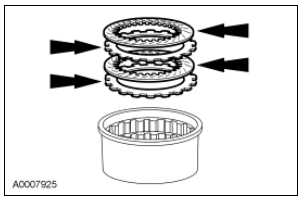
6. **⚠ CAUTION: Coast clutch friction plates are directional and must be installed with grooves clockwise (I.D. to O.D.). The word "TOP" should face up.**

   ⚠ CAUTION: If new clutch plates are being used, they should be soaked in clean automatic transmission fluid before assembly.

   When installing friction plates, the word "TOP" should face up. If reusing plates, grooves must be installed clockwise. Install the coast clutch disc pack.



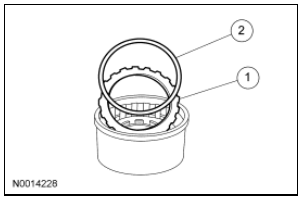
7. Install the 2 steel clutch plates and 2 friction clutch plates in alternating order starting with a steel clutch plate.



8. **⚠ CAUTION: The retaining ring is select fit.**

   Install the coast clutch pressure plate.

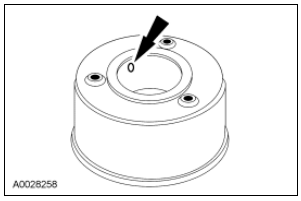
   1. Install the coast clutch pressure plate.
   2. Install the original coast clutch retaining ring.



9. ⚠ **WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air, and make sure drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

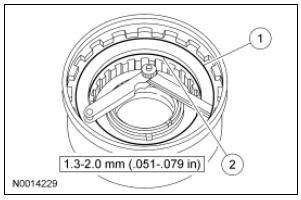
   Air check the assembly.

   - Apply air pressure to the hole in the drum while blocking the other hole with a finger.



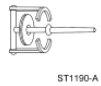
10. Check the coast clutch disc pack free play.
    1. Push down on the coast pressure plate.
    2. Check clearance between the coast clutch retaining ring and coast pressure plate. Clearance should be 1.3-2.0 mm (0.051-0.079 in). If clearance is not within the specification, install a correct coast clutch retaining ring that will provide the correct free play adjustment.

Part Number	Thickness		Diameter	
	mm	In	mm	In
E860126-S	1.37	0.0539	130.1	5.122
E860127-S	1.73	0.0681	130.1	5.122
E860128-S	2.08	0.0819	130.1	5.122
E860129-S	2.44	0.0961	130.1	5.122



Direct Clutch Drum Assembly

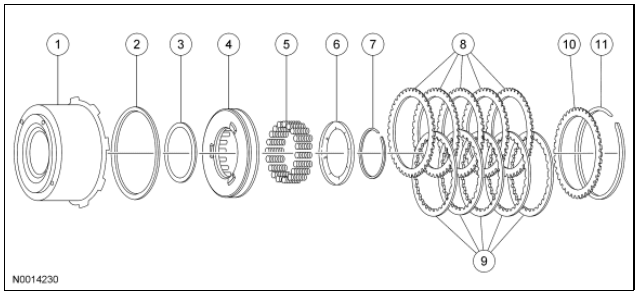
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
ST2431-A	Protector, Piston Seal 307-049 (T74P-77404-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Direct Clutch Drum Assembly

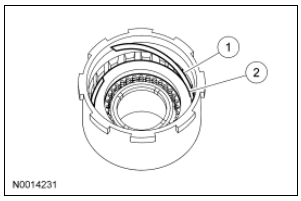


Item	Part Number	Description
1	7D044	Intermediate brake drum assembly
2	7A548	Direct piston outer seal ring
3	7D404	Direct piston inner seal ring
4	7A262	Direct clutch piston
5	7A480	Direct piston spring (20 required)
6	7A527	Direct clutch piston spring retainer
7	E860125-S	Retaining ring
8	7B442	Direct clutch external spline plates
9	7B164	Direct clutch internal spline plates
10	7B066	Direct clutch pressure plate
11	E860126S/129S	Retaining ring (select fit)

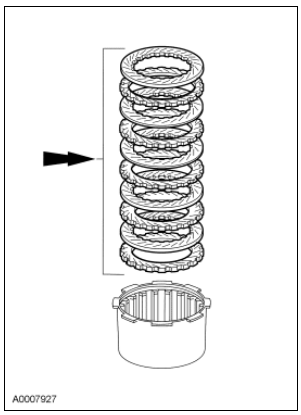
Disassembly

1. Remove the direct clutch retaining ring and the direct clutch pressure plate.

1. Remove the direct clutch retaining ring.
2. Remove the direct clutch pressure plate.



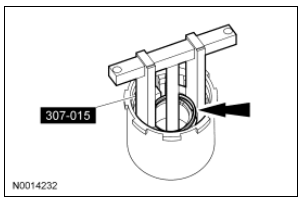
2. Remove the direct clutch disc pack.
    - Inspect and install new friction plates if worn, damaged or overheated.



3. **⚠ WARNING: After removing the retaining ring, use care when releasing the pressure on the springs. Failure to follow these instructions may result in personal injury.**

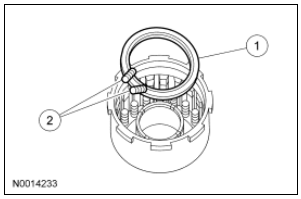
   ⚠ CAUTION: Do not fully compress the special tool or damage to the spring retainer may occur.

   Using the special tool, remove the direct clutch piston retaining ring.



4. Relieve the direct clutch spring tension and remove the special tool.

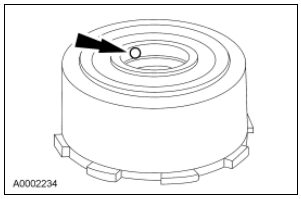
5. Remove the direct clutch piston spring retainer and the direct clutch piston springs.
    1. Remove the direct clutch piston spring retainer.
    2. Remove the direct clutch piston springs.



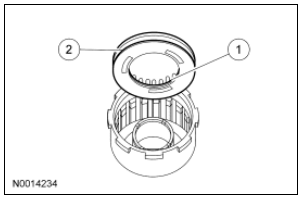
6. **⚠ WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air, and make sure the drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

Using compressed air, remove the direct clutch piston from the direct clutch drum.

- Apply air pressure to the hole in the drum while blocking the other hole with a finger.



7. Remove and discard the direct clutch piston inner and outer seal.
    1. Remove and discard the direct clutch piston inner seal.
    2. Remove and discard the direct clutch piston outer seal.
    - Clean the components as necessary.



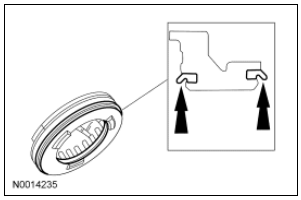
Assembly

1. Inspect the clutch components for damage or wear. Install new components as necessary.
    - Inspect the drum surface for damage.
    - Inspect the clutch piston bore, and piston.
    - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
    - Inspect the clutch plates for damage.
    - Inspect the clutch springs.

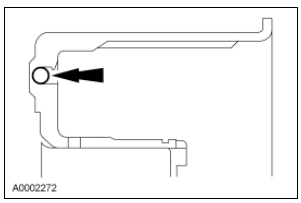
2. ⚠ **CAUTION: The lip seals must be positioned as shown. Care must be taken to prevent rollover of the lip seal.**

    NOTE: Use new seals to help prevent seal failures.

    Install the new direct clutch piston inner seal and the direct clutch piston outer seal.



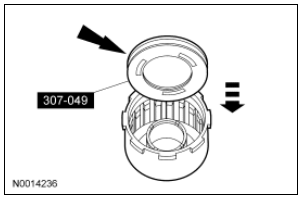
3. Verify the check ball is free to move.



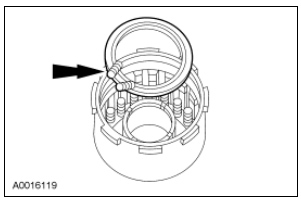
4. ⚠ **CAUTION: Care must be taken to prevent damage to the seals during installation.**

Using the special tool, install the direct clutch piston.

- Lubricate the seals with transmission fluid before installing.



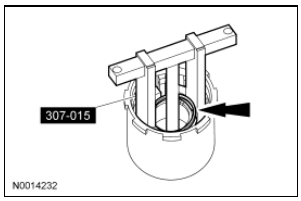
5. Install the direct clutch piston springs and the retainer.



6. **⚠ WARNING: After removing the retaining ring, use care when releasing the pressure on the springs. Failure to follow these instructions may result in personal injury.**

   ⚠ CAUTION: Do not fully compress the special tool or damage to the spring retainer may occur.

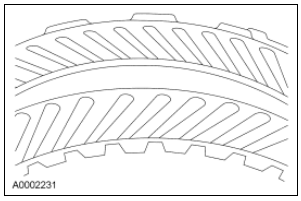
   Using the special tool, install the direct clutch piston retaining ring.



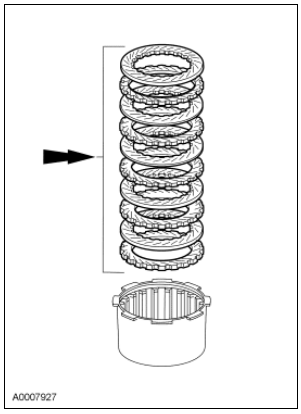
7. **⚠ CAUTION: The direct clutch friction plates are directional and must be installed correctly. Alternate the internally splined (clockwise) and the externally splined (counterclockwise) clutch plates.**

   ⚠ CAUTION: If new plates are used, they should be soaked in clean automatic transmission fluid before assembly.

   When installing friction plates, alternate the internally splined (clockwise) and the externally splined (counterclockwise) clutch plates. Install the direct clutch disc pack.

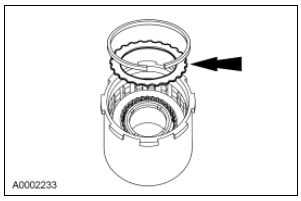


8. Install the friction plates alternating the internally splined (clockwise) and the externally splined (counterclockwise) clutch plates starting with an externally splined (counterclockwise) clutch plate.



9. ⚠ **CAUTION: The retaining ring is a select fit.**

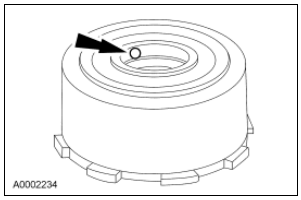
   Install the direct clutch pressure plate using the original direct clutch retaining ring.



10. ⚠ **WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air, and make sure drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

    Air check the assembly.

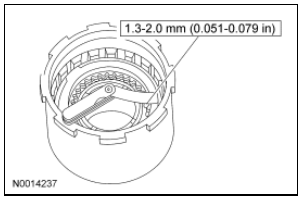
    - Apply air pressure to the hole in the drum while blocking the other hole with a finger.



11. Push down on direct clutch disc pack and check gap between the direct clutch retaining ring and the direct clutch pressure plate with a feeler gauge.
    - If specifications do not match, use a select fit direct clutch retaining ring to match specifications and verify with a feeler gauge.

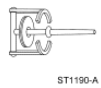
Direct Clutch

Part Number	Thickness		Diameter	
	mm	In	mm	In
E860126-S	1.37	0.0539	130.1	5.122
E860127-S	1.73	0.0681	130.1	5.122
E860128-S	2.08	0.0819	130.1	5.122
E860129-S	2.44	0.0961	130.1	5.122


1.3-2.0 mm (0.051-0.079 in)
N0014237

Forward Clutch

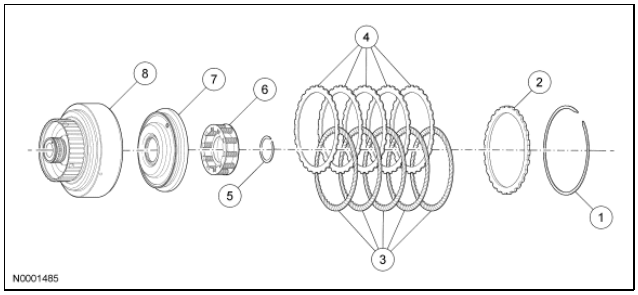
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
ST2534-A	Gauge, Forward Clutch Seal 307-434
ST1813-A	Protector, Piston Seal 307-051 (T74P-77548-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

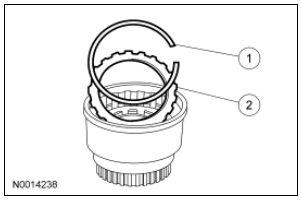
Forward Clutch Assembly



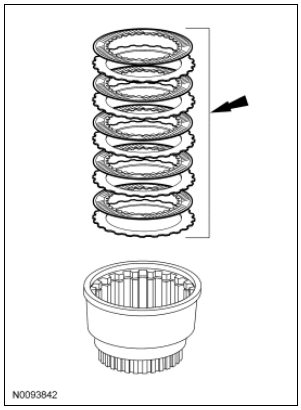
Item	Part Number	Description
1	7D483	Forward clutch retaining ring (select fit)
2	7B066	Forward clutch pressure plate
3	7B164	Forward clutch internal plates — friction (vehicle-dependent)
4	7B442	Forward clutch external plates — steel (vehicle-dependent)
5	E860109	Forward clutch retaining ring
6	7G229	Forward clutch spring assembly
7	7A262	Forward clutch piston
8	7A360	Forward clutch cylinder assembly

Disassembly

1. Remove the pressure plate.
    1. Remove the forward clutch retaining ring.
    2. Remove the pressure plate.



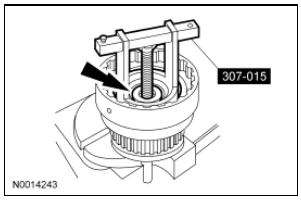
2. Remove the forward clutch disc pack.
    - Inspect the forward clutch plates for wear, damage or overheating.



3. ⚠ **WARNING: While removing or installing the retaining ring, slowly release tool pressure on clutch piston springs. Failure to follow this instruction may cause the assembly to separate forcefully, resulting in serious personal injury.**

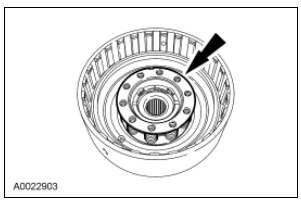
   NOTICE: **Do not fully depress the Clutch Spring Compressor or damage to the spring retainer may occur.**

   Using the Clutch Spring Compressor, remove the forward clutch piston retaining ring.



4. Relieve the forward clutch spring tension and remove the Clutch Spring Compressor.

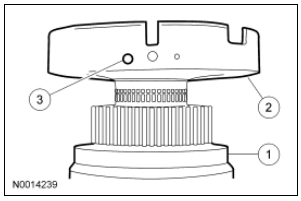
5. Remove the forward clutch piston spring assembly.



6. ⚠ **WARNING: When using compressed air, never let air pressure exceed 138 kPa (20 psi) and always wear safety glasses. Compressed air may cause foreign material or parts to become airborne. Failure to follow this instruction may result in serious personal injury.**

   Remove the forward clutch piston.

   1. Place the forward clutch cylinder with forward clutch piston facing down.
   2. Install the center support on the forward clutch cylinder.
   3. Apply air pressure to the left port of the center support.

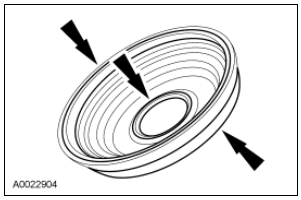


Assembly

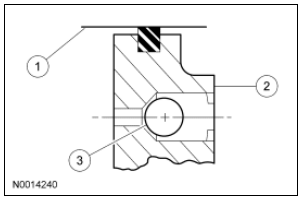
1. Inspect the clutch components for damage or wear. Install new components as necessary.
   - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
   - Inspect the clutch plates for damage.
   - Inspect the clutch springs.
   - Inspect the needle bearing and seal rings for damage.
   - Check clutch hub thrust surfaces for damage.
   - Check clutch plates for flatness and fit on the clutch hub serrations.

2. **NOTE:** If the seals on the forward clutch piston show any signs of damage, a new forward clutch piston will need to be installed.

   Inspect the forward clutch piston and seals.

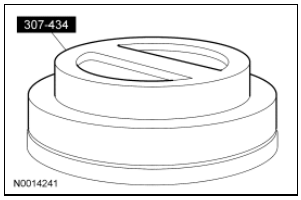


3. Inspect the forward clutch drum assembly.
   1. Inspect the forward clutch cylinder surfaces for scores or burrs.
   2. Inspect the forward clutch piston for scores or burrs.
   3. Verify the check ball is free to move in the piston.



4. **NOTE:** The Forward Clutch Seal Gauge must be installed on the forward clutch piston for a couple of minutes prior to installing it into the forward clutch cylinder.

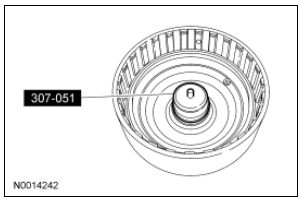
   Install the Forward Clutch Seal Gauge on the forward clutch piston.



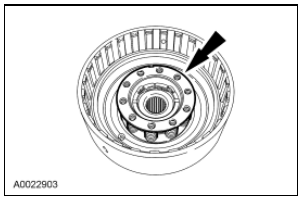
5. ***NOTICE:*** **Care must be taken to prevent damage to the seals.**

   NOTE: Lubricate the forward clutch piston inner and outer seal with transmission fluid.

   Using the Piston Seal Protector, install the forward clutch piston assembly into the forward clutch cylinder.

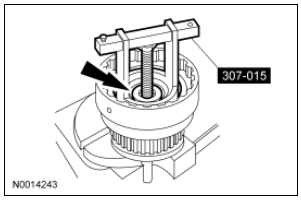


6. Install the forward clutch piston spring assembly.



7. ***NOTICE:*** **Do not fully depress the Clutch Spring Compressor or damage to the spring retainer may occur.**

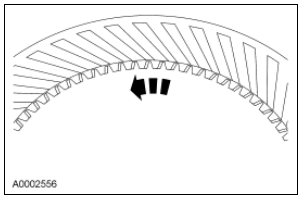
   Using the Clutch Spring Compressor, install the forward clutch piston spring retaining ring.



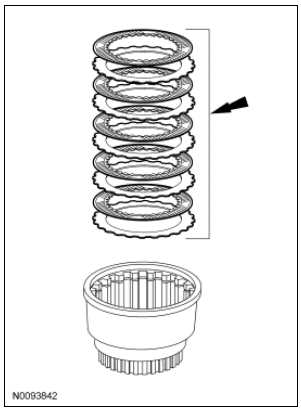
8. ***NOTICE:*** **The forward clutch friction plates are directional and must be installed with grooves pointing counterclockwise, otherwise transmission damage can occur.**

   NOTICE: **If new plates are used, they should be soaked in transmission fluid before assembly, or damage to the plates may occur.**

   If reusing plates, grooves must be installed counterclockwise. Install the forward clutch disc pack.



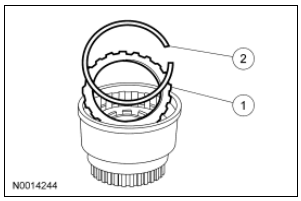
9. Install the steel clutch plates and friction clutch plates in alternating order starting with a steel clutch plate.



10. **NOTE:** The retaining ring is a select fit.

    Install the original selective retaining ring.

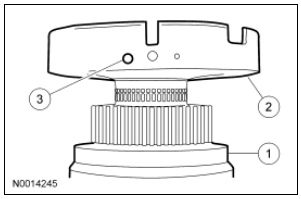
    1. Install the forward clutch pressure plate.
    2. Install the original selective retaining ring.



11. ⚠ **WARNING: When using compressed air, never let air pressure exceed 138 kPa (20 psi) and always wear safety glasses. Compressed air may cause foreign material or parts to become airborne. Failure to follow this instruction may result in serious personal injury.**

    Air check the forward clutch piston.

    1. Place the forward clutch cylinder with forward clutch piston facing down.
    2. Install the transmission center support on the forward clutch cylinder.
    3. Apply air pressure to the left port of the center support.

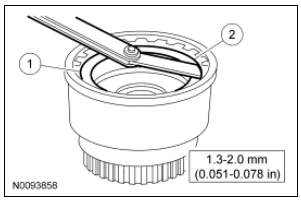


12. Check the forward clutch disc pack free play.
    1. Press down on the forward clutch disc pack.
    2. Using a feeler gauge, check the gap between the forward clutch retaining ring and the forward clutch pressure plate.

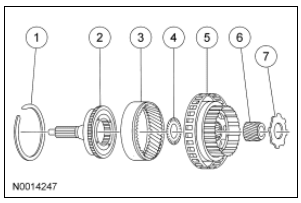
    • If the clearance is not within specifications, install the correct size retaining ring.

Part Number	Thickness		Diameter	
	mm	Inch	mm	Inch
XW4Z-7D483-AB	1.73	0.068	141.45	5.568

XW4Z-7D483-AC	2.08	0.081	141.45	5.568
XW4Z-7D483-AD	2.44	0.096	141.45	5.568



Overdrive Planetary and One-Way Clutch Assembly



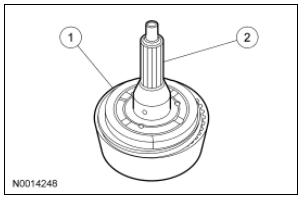
Item	Part Number	Description
1	W702037-S300	Retaining ring
2	7A658	Center shaft
3	7653	Overdrive ring gear
4	7L495	No. 2 overdrive planetary thrust bearing
5	7B446	Overdrive planetary gear carrier assembly
6	7D063	Overdrive sun gear
7	7660	Coast clutch adapter

Disassembly

1. **NOTE:** The overdrive one-way clutch is serviced with the center shaft assembly.

   Remove the center shaft from the overdrive ring gear.

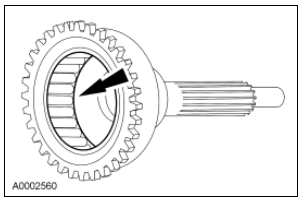
   1. Remove the overdrive center shaft retaining ring.
   2. While rotating counterclockwise remove the center shaft from the ring gear.



2. ⚠ **CAUTION: Do not remove the overdrive one-way clutch. Damage to the clutch may occur if it is removed.**

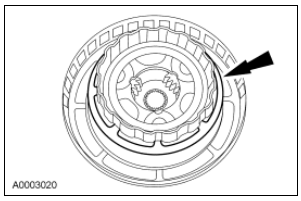
   Clean and inspect the overdrive one-way clutch and center shaft.

   - Inspect for cracks in the roller cage and wear on the roller clutch, and the press fit of the one-way clutch to the center shaft.



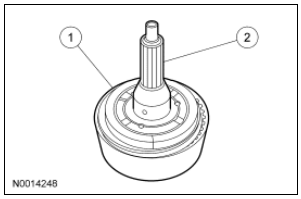
3. Inspect the one-way clutch.
   - Temporarily insert the overdrive planetary gear carrier assembly into the one-way clutch rollers for verification of the one-way clutch.

- The planetary gear must rotate counterclockwise and hold when rotated clockwise.
- Remove the planetary gear carrier assembly.



Assembly

1. Install the center shaft and one-way clutch.
    1. Install the center shaft and one-way clutch.
    2. Install the center shaft retaining ring.

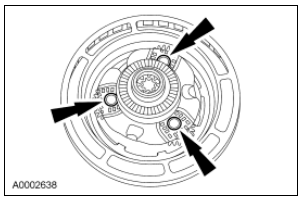


Overdrive Planetary Gears

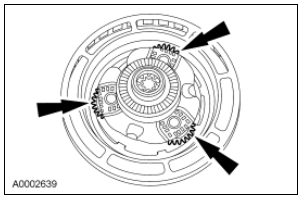
Disassembly

1. **NOTE:** Individual parts of the planetary carriers are not serviceable.

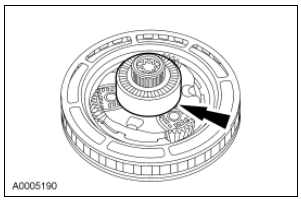
   Before installing a planetary assembly, the shaft retaining pins should be checked for adequate staking. Check the pins and shafts in the planetary assemblies for loose fit and/or complete disengagement. Install a new planetary assembly if necessary.



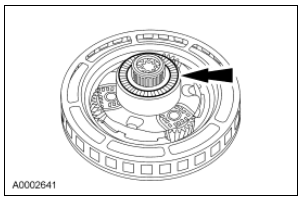
2. Inspect the pinion gears for damaged or excessively worn teeth and for free rotation.



3. Inspect the Overdrive (O/D) One-Way Clutch (OWC) inner race and the inner and outer races for scored or damaged surface areas where the rollers contact the races.

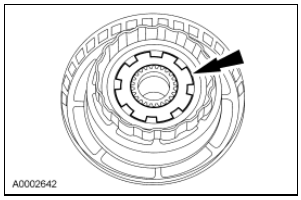


4. Remove and inspect the No. 2 O/D planetary thrust bearing on the nose of the O/D planetary gear carrier assembly.

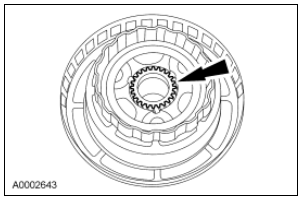


5. **NOTE:** Inspect the sun gear for damaged or worn teeth.

   Remove the coast clutch-to- O/D carrier adapter.

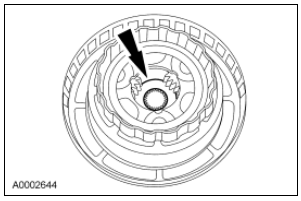


6. Remove and inspect the O/D sun gear.



7. ***NOTICE:*** **Do not attempt to remove the No. 12 bearing from behind the pinion gears or transmission damage can occur.**

   Inspect the No. 12 bearing for damage.

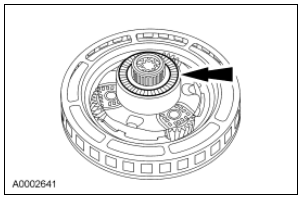


Assembly

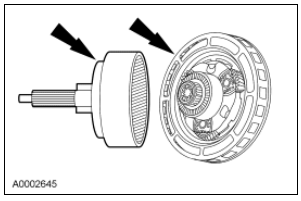
1. **NOTE:** Thoroughly clean all parts and blow dry with moisture-free compressed air.

   NOTE: Use petroleum jelly to hold the No. 2 O/D planetary thrust bearing in place.

   Install the No. 2 O/D planetary thrust bearing.

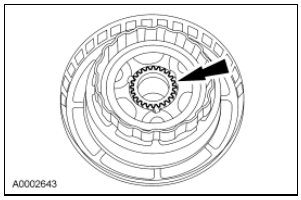


2. Install the O/D planetary gear carrier into the center shaft and O/D .



3. **NOTE:** Make sure that the No. 12 bearing is in place in the O/D planetary prior to installing the O/D sun gear.

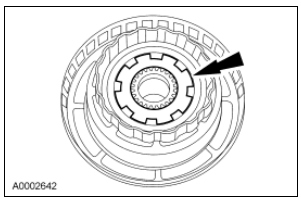
   Install the O/D sun gear with the recessed gear teeth facing toward the adapter.



4. **NOTE:** Adapter part number must not be visible after installation.

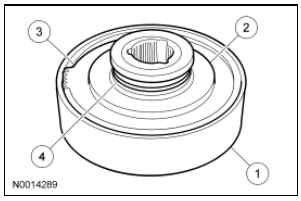
   NOTE: Inspect the sun gear for damaged or worn teeth.

   Install the coast clutch-to- O/D carrier adapter.



Output Shaft Ring Gear and Hub Shaft Assembly

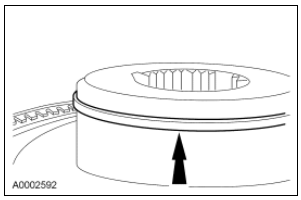
Disassembly



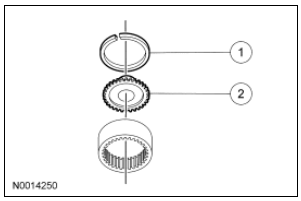
Item	Part Number	Description
1	7A153	Output shaft ring gear
2	7D164	Output shaft hub
3	7C122	Retaining ring
4	7D019	Output shaft hub seal

1. Inspect the output shaft ring gear and hub shaft assembly for damage. If repair is necessary, use the following procedure.

2. Remove the seal.

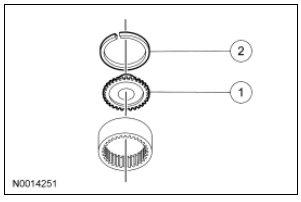


3. Remove the output shaft ring gear from the output shaft hub.
    1. Remove the retaining ring.
    2. Remove the output shaft ring gear.

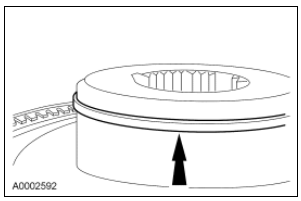


Assembly

1. Install the output shaft ring gear onto the output shaft hub.
    1. Install the output shaft ring gear.
    2. Install the retaining ring.

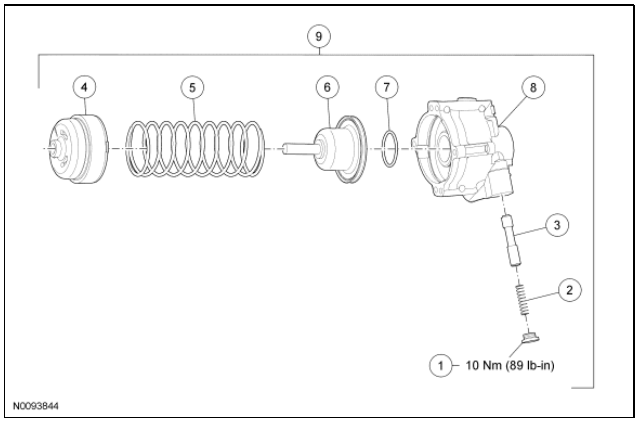


2. Install the seal.



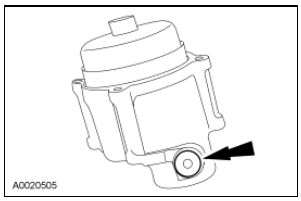
Reverse Servo Assembly

Disassembly

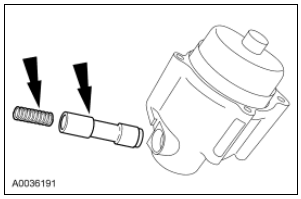


Item	Part Number	Description
1	—	Control valve spring retainer (part of 7D036)
2	—	Fluid pressure regulator valve spring (part of 7D036)
3	—	Reverse servo check valve (part of 7D036)
4	7D372	Reverse servo plate
5	7D466	Reverse servo accumulator spring
6	7D189	Reverse servo piston and seal
7	—	Reverse servo piston O-ring (part of 7D036)
8	7D036	Reverse servo cover
9	7B193	Reverse servo assembly

1. Remove the control valve spring retainer.



2. Remove the reverse servo spring and check valve.

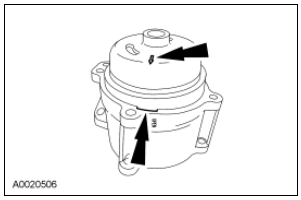


3. ⚠ **WARNING: Follow the specified procedure when using the tool to remove the servo cover. The servo and servo cover are under high spring force and can separate forcefully, which may result in serious personal injury.**

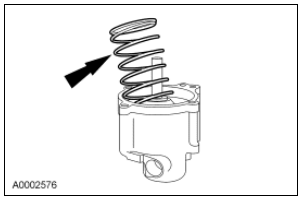
NOTE: Tabs on servo plate mate with slots on cover every 120 degrees.

Remove the reverse servo plate by turning in either direction to release.

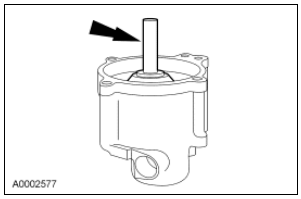
- Align the arrow on the servo plate with any slot on the cover.



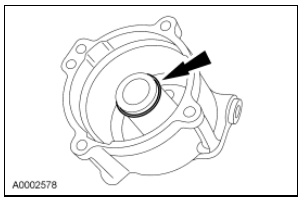
4. Remove the reverse servo spring.



5. Remove the reverse servo piston and seal assembly.
   - Inspect the seal for damage, install a new reverse servo piston if necessary.



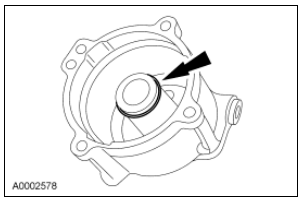
6. Remove and discard the reverse servo piston seal.



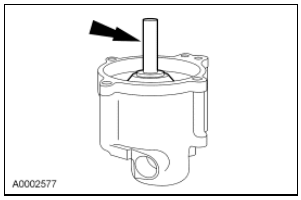
Assembly

1. ***NOTICE:*** **Try not to roll the seal onto the housing when installing the seal or damage to the seal may occur.**

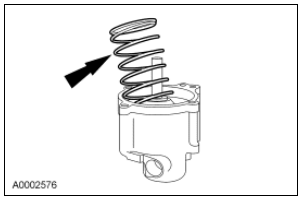
   Lubricate and install a new reverse servo piston seal.



2. Lubricate and install the reverse servo piston and seal assembly.



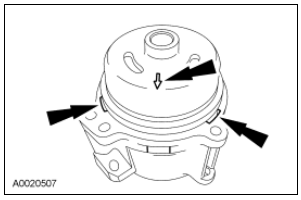
3. Install the reverse servo spring.



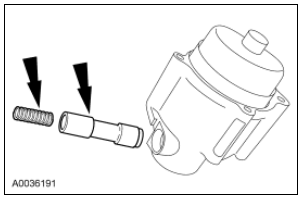
4. ⚠ **WARNING: Follow the specified procedure when using the tool to remove the servo cover. The servo and servo cover are under high spring force and can separate forcefully, which may result in serious personal injury.**

   NOTE: The arrow on the servo plate must be aligned evenly between any 2 slots on the cover.

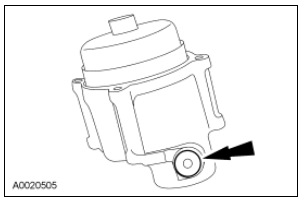
   Install the reverse servo plate.



5. Install the reverse servo spring and check valve.

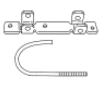


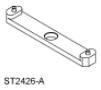
6. Install the control valve spring retainer.
   - Tighten to 10 Nm (89 lb-in).



Transmission

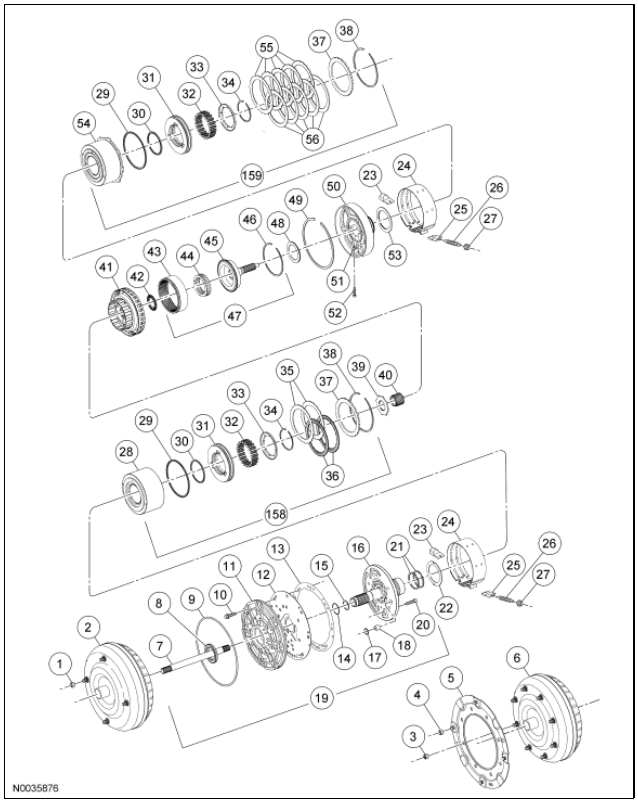
Special Tool(s)

ST1792-A	Adjustment Set, Transmission Band 307-S022 (T71P-77370-A)
ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
ST1274-A	Depth Micrometer 303-D026 (D80P-4201-A) or equivalent
ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
ST1188-A	Installer, Transmission Extension Housing Oil Seal 307-038 (T74P-77052-A)
ST1826-A	Sizer, Piston Seal 307-338 (T95L-70010-G)
ST1817-A	Alignment Set, Fluid Pump 307-S039 (T74P-77103-X)
ST2532-A	Aligner, Fluid Pump Handle 307-431
ST2533-A	Aligner, Fluid Pump Pilot 307-432
ST2432-A	Gauge Bar 307-400
 ST2393-A	Compressor, Servo Cover 307-402
ST1199-A	Installer, Shift Shaft Fluid Seal 307-050 (T74P-77498-A)
ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)

ST2424-A	Compressor, Cushion Spring 307-401
ST1639-A	Aligner, Valve Body 307-334 (T95L-70010-C)
ST2433-A	Alignment Pins, Transmission Pump 307-399
 ST2426-A	Aligner, Flex Plate 307-403
ST2538-A	Air Test Plate 307-433-01, 307-433-2, 307-433-3
ST2440-A	Installer, Drive Pinion flange 205-479
ST2416-A	Installer, Output Shaft Flange 307-404

Material

Item	Specification
MERCONï¿½ V Automatic Transmission Fluid XT-5-QM	MERCONï¿½ V
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B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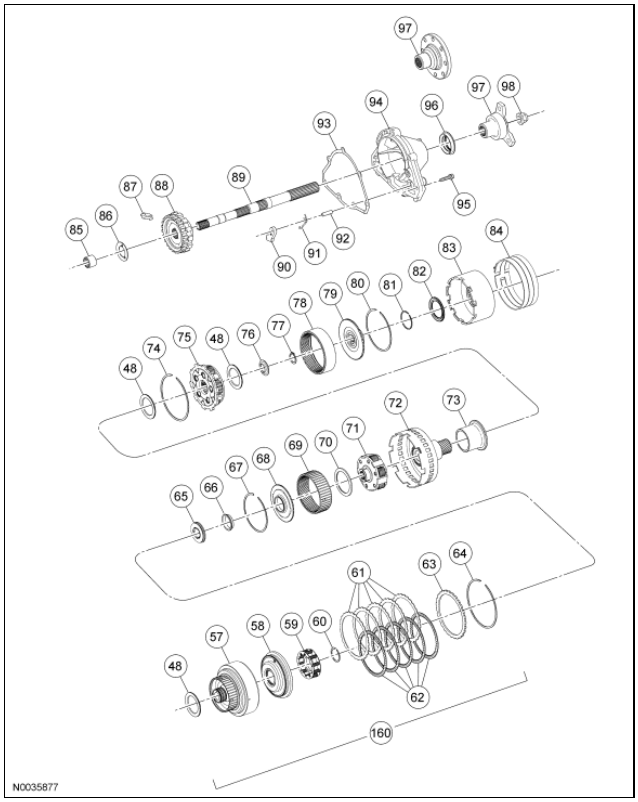
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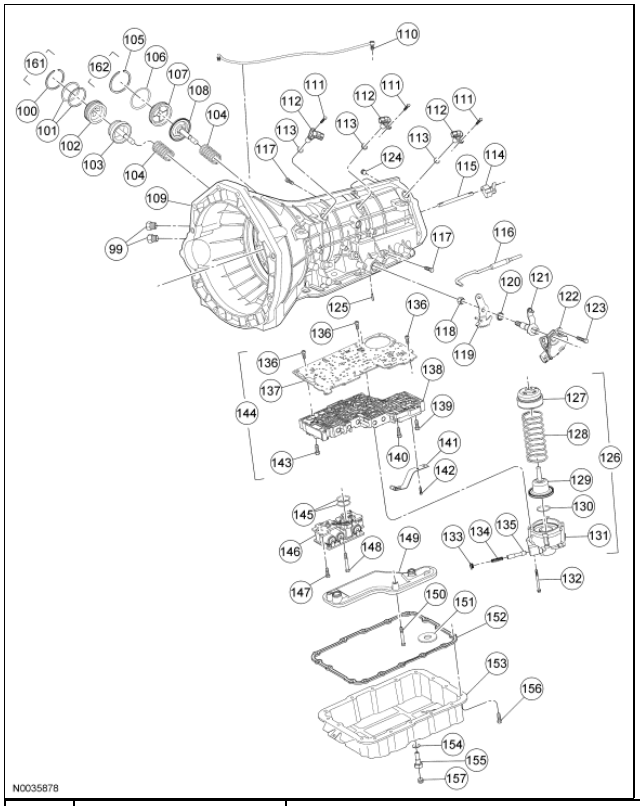


Item	Part Number	Description
1	379299-S2	Converter-to-flexplate nut (attaches the converter assembly to the flexplate)
2	7902	Converter assembly (3.0L)
3	379299-S2	Converter-to-adapter plate nut (attaches the converter assembly to the adapter plate) (8 required)
4	379299-S2	Adapter plate-to-flexplate nut (attaches adapter plate to the flexplate) (4 required)
5	6K374	Adapter plate assembly
6	7902	Converter assembly
7	7017	Input shaft
8	7A248	Front fluid pump seal assembly
9	7A248	Front fluid pump seal
10	W704892-S1300	Screw and washer assembly — M8 x 35 internal lobe (attaches pump to case) (8 required)
11	7G178	Fluid pump cover assembly
12	7B472	Fluid pump adapter plate
13	7A136	Front fluid pump gasket
14	W701431-S300	Fluid pump shaft-to-inner gear O-ring seal (also in pump assembly)
15	7L323	Stator support seal
16	7A108	Front pump support assembly
17	7H416	O-ring
18	7H411	Fluid pump control valve
19	7A103	Fluid pump assembly
20	W701429- S300	M8 x 1 x 35 internal lobe screw (attaches pump support to pump assembly) (6 required)

21	7D025	Overdrive brake drum seal
22	7D014	Fluid pump input thrust washer No. 1
23	7D029	Intermediate and overdrive brake band anchor strut (2 required)
24	7D034	Intermediate and overdrive brake band (2 required)
25	7D029	Intermediate and overdrive brake band apply strut (2 required)
26	7C492	Overdrive/intermediate band adjusting screw
27	71000-S100	Overdrive/intermediate locking nut
28	7L669	Overdrive brake band drum assembly
29	7A548	Direct and overdrive piston outer seal
30	7D404	Direct and overdrive piston inner seal
31	7A262	Direct and overdrive clutch piston
32	7A480	Direct and overdrive clutch piston spring
33	7A527	Clutch piston spring retainer (2 required)
34	E860125-S	Retaining ring (retains 7D041 to drum) (2 required)
35	7B442	Coast clutch external splined plate (steel) (2 required)
36	7B164	Coast clutch internal splined friction plate (2 required)
37	7B066	Coast and direct clutch pressure plate (2 required)
38	E860126-S	Coast and direct clutch plates retaining ring (select fit) (2 required)
39	7660	Coast clutch to overdrive carrier adapter
40	7D063	Overdrive sun gear
41	7B446	Overdrive planetary gear carrier (with trigger wheel)
42	7L495	Overdrive planet thrust bearing No. 2
43	7A153	Overdrive ring gear
44	7A089	Center shaft one-way clutch assembly
45	7A658	Overdrive center shaft
46	W702037-S300	Retaining ring (retains 7686 to 7653)
47	7L678	Hub and ring gear assembly (includes 7C109, 7A153, 7A658, W702037-S300)
48	7M153	Center shaft and forward clutch cylinder bearing assembly No. 3, No. 5, No. 8 and No. 9 (4 required)
49	W702465-S300	Retaining ring
50	7A130	Center support assembly
51	E826160-S76	Nut and cage assembly (attaches center support to case)
52	W705407-S300	Bolt
53	7D014	Intermediate clutch drum bearing No. 4
54	7D044	Intermediate brake drum assembly
55	7B442	Direct clutch external splined steel plates (5 required)
56	7B164	

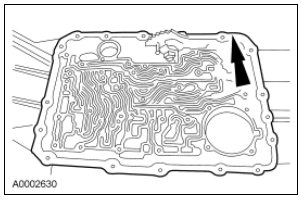
		Direct clutch internal splined friction plates (5 required)
57	7A360	Forward clutch cylinder
58	7A262	Forward clutch piston assembly
59	7G299	Forward clutch support and spring assembly
60	E860109-S	Forward clutch piston and spring retaining ring in forward clutch cylinder
61	7B442	Forward clutch external spline steel plate (5 required)
62	7B164	Forward clutch internally spline friction plate (5 required)
63	7B066	Forward clutch pressure plate
64	7D483	Retaining ring 141.45 x 1.37 internal (select fit)
65	7D234	Forward ring gear hub thrust bearing No. 6A
66	7D090	Forward clutch thrust washer No. 6B
67	7G375	Forward clutch hub retainer ring
68	7B067	Forward ring gear hub
69	7D392	Forward ring gear
70	7F374	Forward planet thrust bearing No. 7
71	7A398	Forward planetary
72	7A019	Shell and sun gear assembly
73	7C176	Low and reverse spacer gear
74	W702775-S300	Reverse carrier drum snap ring
75	7D006	Reverse planet assembly
76	7B167	Output shaft sleeve
77	E860527-S	External retainer ring
78	7A153	Output shaft ring gear
79	7D164	Output shaft hub
80	7C122	Output shaft ring gear retaining ring
81	7D019	Output shaft hub seal
82	7H027	Low/intermediate sun gear bearing assembly
83	7C498	Reverse brake drum and clutch assembly (includes OWC)
84	7D095	Low/reverse band assembly
85	7R205	Output shaft bearing
86	7B368	Output shaft thrust washer (No. 11)
87	7C058	Deflector assembly
88	7A233	Transmission parking gear assembly
89	7060	Output shaft
90	7A441	Parking pawl
91	7D070	Parking pawl return spring
92	7D071	Parking pawl shaft
93	7086	Extension housing gasket
94	7A039	Extension housing
95	W500311-S437	

		M8 x 1.25 extension housing-to-case screw (5 required)
96	7052	Extension housing seal
97	7089	Output shaft flange
98	W701357	Output shaft flange nut
99	7D273	Fluid tube connector assembly (2 required)
100	7H074	Ring overdrive servo retainer
101	W703119-S300	Overdrive servo cover seal (2 required)
102	7D027	Overdrive servo cover
103	7D021	Overdrive servo piston and rod
104	7D028	Intermediate/overdrive servo piston spring (2 required)
105	W702777-S300	Ring intermediate servo retainer
106	W702969-S300	Intermediate servo cover seal
107	7D027	Intermediate servo cover
108	7D021	Intermediate servo piston and rod
109	7005	Case assembly
110	7034	Case vent assembly
111	W708389-S437	Speed sensor-to-case screw (M6 x 19)
112	7H103	Output shaft speed, turbine shaft speed and intermediate shaft speed sensors
113	W702981-S300	Speed sensor-to-case O-ring seal
114	7A179	Reverse brake drum lever
115	7D433	Reverse band actuating lever shaft
116	7A232	Parking pawl actuating rod
117	390318-S2	Pipe plug
118	W703001-S437	Manual lever shaft outer and inner nut
119	7A115	Manual valve inner lever
120	7B498	Manual control lever seal
121	7A256	Manual control lever
122	7F293	Digital transmission range (TR) sensor
123	W500015-S437	Digital TR sensor screw and washer (2 required)
124	6026	Fluid fill plug
125	7B210	Manual lever shaft pin retainer
126	7B193	Reverse servo assembly
127	7D372	Reverse servo plate
128	7D466	Reverse servo accumulator spring
129	7D189	Reverse servo piston and seal
130	7423	Reverse servo piston O-ring seal
131	7D036	Reverse servo cover
132	W709492-S300	Reverse servo piston-to-case screw (4 required)
133	7D321	Control valve spring retainer
134	7A270	Main fluid pressure spring regulator valve
135	7D488	Reverse servo check valve

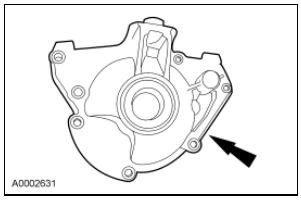
136	W701099-S1430	Main control valve body separating plate screw
137	7Z490	Main control valve body separating plate (bonded)
138	7A101	Lower main control valve body
139	W500102-S300	Main control valve body screw (18 required)
140	W702791-S300	Main control valve body screw
141	7E332	Manual valve detent spring
142	W500100-S300	Screw detent spring
143	W706672-S430	Main control valve body screw
144	7A100	Main control valve body
145	W705928-S300	Solenoid body connector O-ring seal
146	7G391	Transmission control solenoid body
147	W702921-S300	Transmission control solenoid body screw
148	W703189-S300	Transmission control solenoid body screw (7 required)
149	7A098	Transmission fluid pan filter
150	W705559-S300	Transmission fluid pan filter screw
151	7L027	Transmission fluid pan magnet
152	7A191	Transmission fluid pan gasket
153	7A194	Transmission fluid pan
154	6734	Transmission fluid pan drain plug gasket
155	7A010	Transmission fluid pan drain plug
156	W500213-S437	Transmission fluid pan screw
157	W704999-S309	Transmission fluid pan drain tube plug (short hex)
158	—	Overdrive/coast clutch assembly
159	—	Direct clutch assembly
160	—	Forward clutch assembly
161	—	Overdrive servo
162	—	Intermediate servo

1. Thoroughly clean the transmission case and extension housing in solvent and blow dry with compressed air.

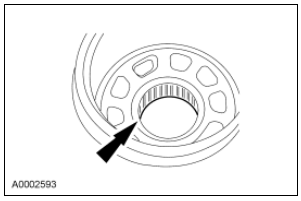
2. Inspect the transmission case for the following:
   - Stripped bolt hole threads
   - Gasket and mating surfaces for burrs or nicks
   - Obstructions to vent and fluid passages
   - Cracks or warpage



3. Inspect the extension housing for cracks, burrs or warpage.

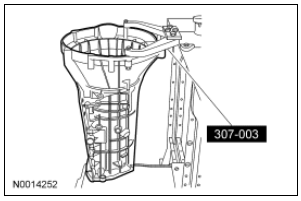


4. Inspect the case bearing for damage. If damage to the case bearing is indicated, install a new case.

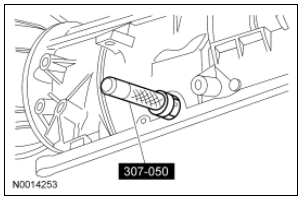


5. ⚠ **WARNING: Make sure the lock pin on the bench-mounted holding fixture is secure. Failure to follow these instructions may result in personal injury.**

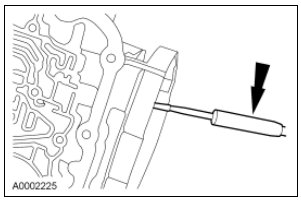
   Using the special tool, install the transmission into the bench with the converter housing facing up.



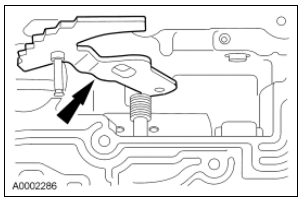
6. Using the special tool, install the manual control lever shaft seal and lubricate it with petroleum jelly.



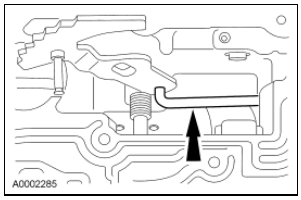
7. Install the parking lever rod.



8. Install the manual control lever.

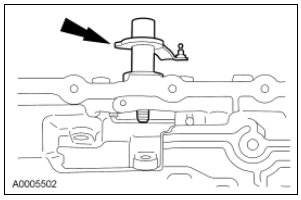


9. Assemble the manual valve inner lever and parking lever actuating rod as shown.

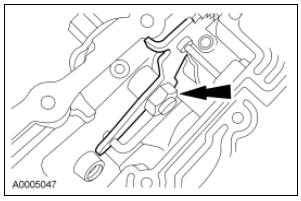


10. ⚠ **CAUTION: Align the flats on the manual valve inner lever with the flats on the manual control lever shaft.**

    Install the manual control lever shaft.



11. Install the manual valve inner lever onto the manual shaft and loosely install the nut.

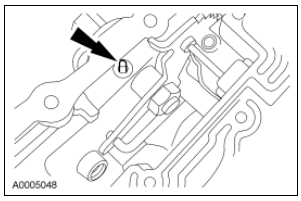


12. ⚠ **CAUTION: Use care not to damage the fluid pan rail surface when installing the retaining pin.**

    NOTE: Align the manual control lever shaft alignment groove with the manual control lever shaft spring pin bore in the transmission case.

    Install the manual control lever shaft spring pin.

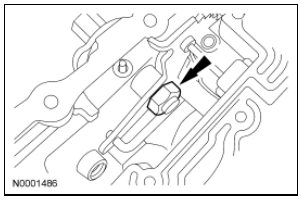
    - Tap the manual control lever shaft spring pin into the transmission case.



13. ⚠ **CAUTION: To avoid damage, do not allow the wrench to strike the manual valve inner lever pin.**

    Tighten the nut.

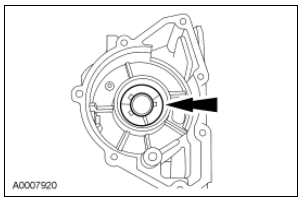
    - Tighten to 48 Nm (35 lb-ft).



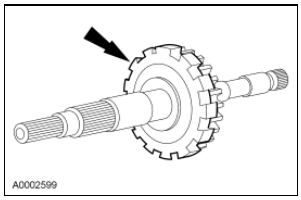
14. ⚠ **CAUTION: The tabs on the output shaft thrust washer (No. 11) point into the case. Make sure the thrust washer is correctly seated.**

    Install the output shaft thrust washer (No. 11).

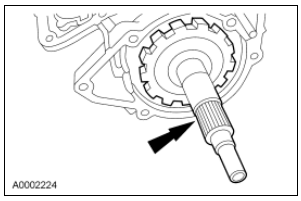
    - Coat the output shaft thrust washer with petroleum jelly.



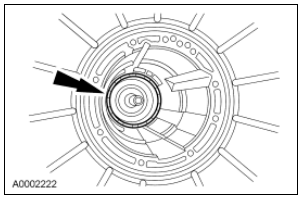
15. Install the park gear on the output shaft.



16. Install the output shaft and park gear.

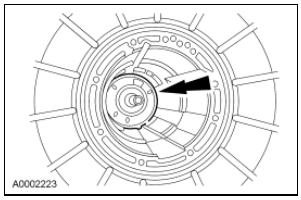


17. Install the low/reverse brake drum.
    - Rotate the low/reverse brake drum clockwise to install.



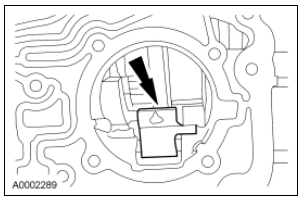
18. ⚠ **CAUTION: Make sure band is resting on the 2 anchor pins in the case.**

    Install the low/reverse band over the reverse drum.

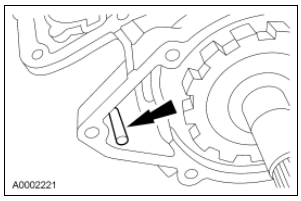


19. **NOTE:** The reverse band actuating lever must fit into the notches in the band.

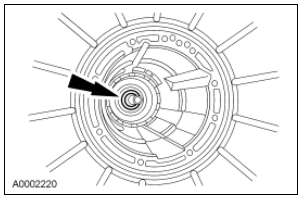
    Install the reverse band actuating lever into the reverse band.



20. Install the reverse band actuating lever shaft into the case and into the reverse band actuating lever.

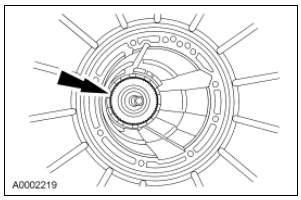


21. Install the No. 10 needle bearing into the case.



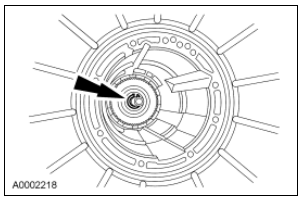
22. ⚠ **CAUTION: Do not damage the seal against the case during assembly.**

    Install the output shaft ring gear, hub and seal.



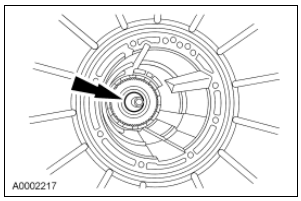
23. ⚠ **CAUTION: Always install a new output shaft retaining ring.**

    Install a new output shaft retaining ring.

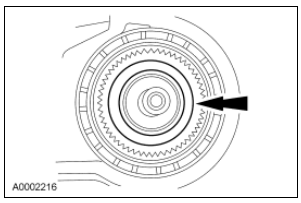


24. **NOTE:** Install the output shaft sleeve with the cone facing up. This sleeve will snap into place when correctly installed.

    Install the output shaft sleeve.

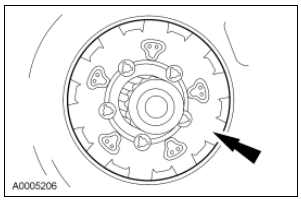


25. Install the low/reverse planetary carrier needle bearing (No. 9) onto the output shaft ring gear and hub assembly.



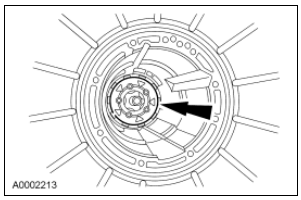
26. ⚠ **CAUTION: Make sure the needle bearings stay in place.**

    Install the low/reverse planetary assembly.

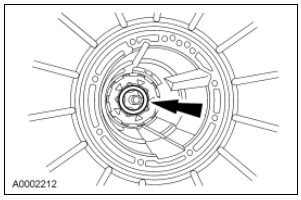


27. ⚠ **CAUTION: The low/reverse brake drum must be pulled forward to install the low/reverse planet retaining ring.**

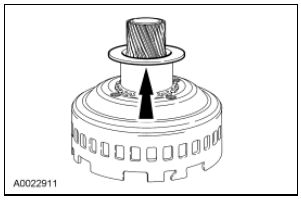
    Install the retaining ring.



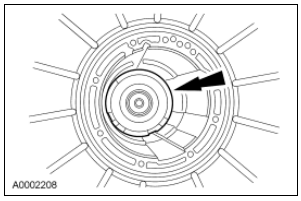
28. Install the No. 8 thrust bearing.



29. Install the spacer on the input shell, using petroleum jelly to hold it in place.

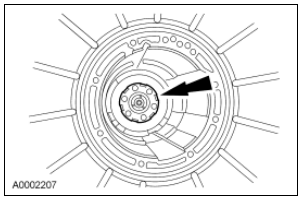


30. Install the input shell and sun gear assembly.

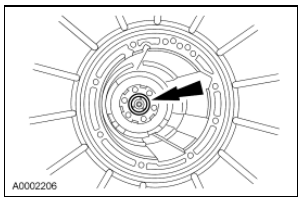


31. **NOTE:** The No. 13 bearing must be correctly seated in the forward planet assembly so the sun gear can be installed correctly.

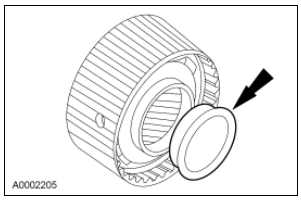
    Install the forward planetary assembly.



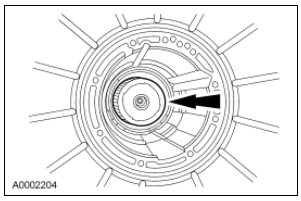
32. Install the No. 7 forward planet thrust bearing into the forward ring gear and hub assembly. Use petroleum jelly to hold the bearing in place.



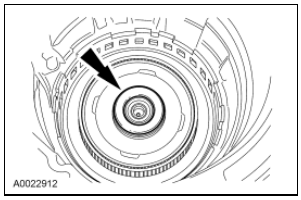
33. Install the No. 6B forward clutch thrust washer onto the forward ring gear hub.



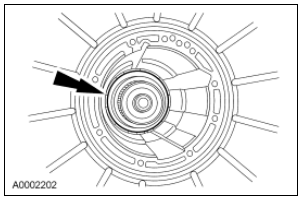
34. Install the forward ring gear and hub as an assembly.



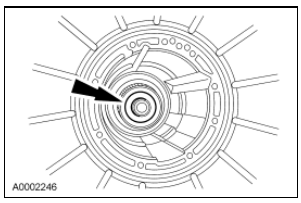
35. Install the No. 6A forward ring gear hub thrust bearing into the forward ring gear and hub.



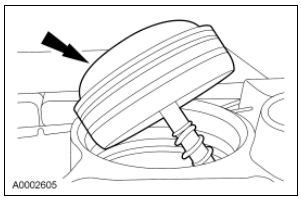
36. Install the forward clutch cylinder.



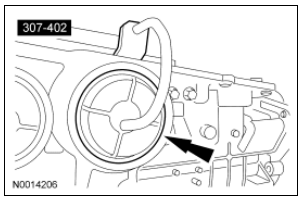
37. Install the No. 5 thrust bearing.



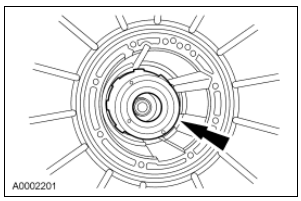
38. Install the intermediate servo piston and spring.
    - Lubricate the servo bore with clean automatic transmission fluid.



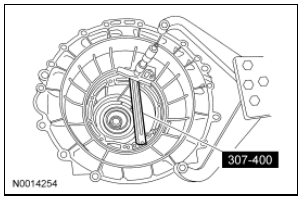
39. Using the special tool, install the retaining ring.



40. Install the direct clutch drum.



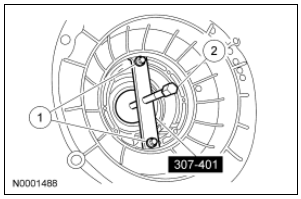
41. Using a depth micrometer with an appropriate length extension, measure from the top of the gauge bar to the center support ledge in the case at 4 places 90 degrees apart.
    - Add the 4 measurements, divide by 4, and record as dimension A.



42. ⚠ **CAUTION: The torque specifications are critical for this procedure. Failure to use the correct torque specifications may cause transmission damage.**

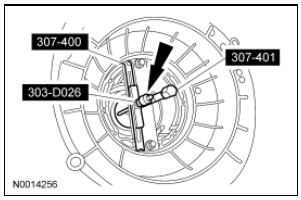
    Install the special tool.

    1. Install the special tool and the bolts using the 2 pump screw locations at approximately 6 and 12 o'clock positions.
        - ♦ Tighten to 15 Nm (11 lb-ft).
    2. Tighten the center screw.
        - ♦ Tighten to 1.13 Nm (10 lb-in).



43. **NOTE:** Align the disc holes on the special tool with the slot in the gauge bar for correct measurement.

    Measure the distance from the top of the gauge bar to the drum bearing surface through the hole in the disc, and record as dimension B. Repeat the measurement 180 degrees on the opposite side of the special tool and record as dimension C.



44. Add dimension B to C, divide by 2, and record as dimension D.

45. Subtract A from D and record as dimension E.

46. Select bearing from the following chart, using dimension E.

Dimension E	Service Part Number (7D014)	Bearing Thickness	Identification (Notches)
1.69-1.87 mm (0.066-0.074 in)	XW4Z-CA	2.65-2.80 mm (0.104-0.110 in)	None
1.88-2.04 mm (0.073-0.080 in)	XW4X-DA	2.83-2.98 mm (0.111-0.116 in)	One
2.05-2.22 mm (0.081- 0.088 in)	XW4Z-EA	3.01-3.16 mm (0.118-0.124 in)	Two

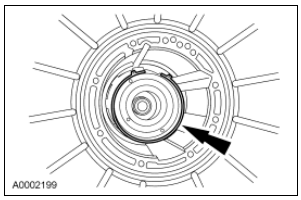
2.23-2.43 mm (0.088-0.096 in)	XW4Z-FA	3.21-3.36 mm (0.126-0.132 in)	Three

47. **NOTE:** Make sure that the intermediate band apply strut is aligned with the band notch.

    NOTE: If the intermediate band is reused, it must be installed in the same position as when removed.

    NOTE: The new intermediate band is dark in color. This is a normal condition of the band. Hairline cracks in the band are also considered normal. Do not install a new band based solely on the color.

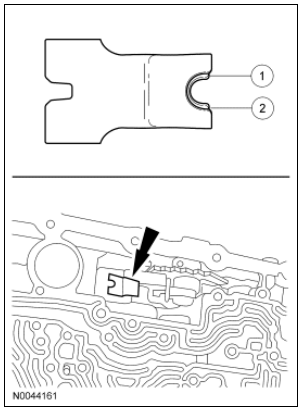
    Install the intermediate band.



48. **⚠ CAUTION: To avoid a "fall-out" condition of the strut from the screw during assembly and function, the small "U" shaped notch should be toward the band/case side and the large "U" shaped notch toward the main control side.**

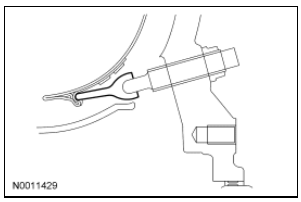
    Install the intermediate band anchor strut.

    1. Band/case side of the anchor (small U notch).
    2. Main control side of the anchor (large U notch).

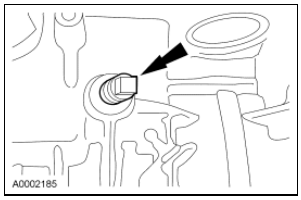


49. **⚠ CAUTION: If the strut is installed incorrectly, transmission damage will occur.**

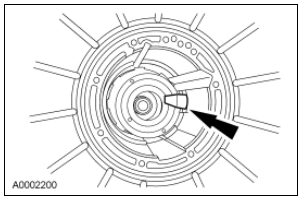
    Check to make sure that the intermediate band anchor strut is installed in the correct orientation to the case and adjustment screw.



50. Loosely install the screw.

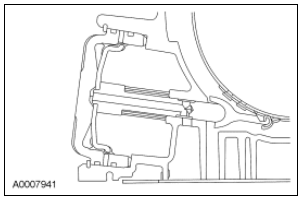


51. Install the intermediate band apply strut.

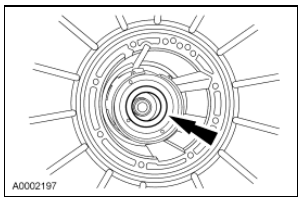


52. ⚠ **CAUTION: If the strut is installed incorrectly, transmission damage will occur.**

    Check to make sure that the intermediate band apply strut is installed in the correct orientation to the case and piston rod.

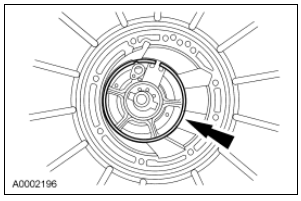


53. Install the selected No. 4 thrust washer on the direct clutch drum.
    - Coat the thrust washer with petroleum jelly.

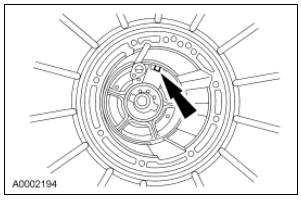


54. **NOTE:** Align the center support screw hole with the correct case hole.

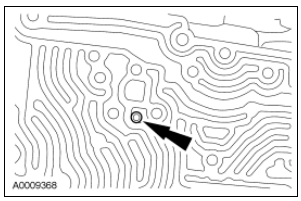
    Install the center support.



55. Install the center support locknut and cage.



56. Loosely install the screw.

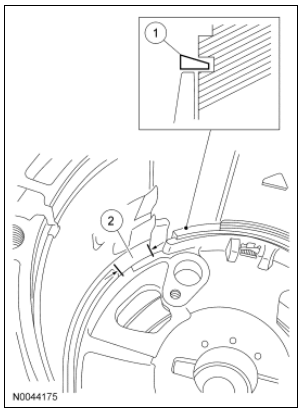


57. ⚠ **CAUTION: Install the center support retaining ring with the tapered side facing up.**

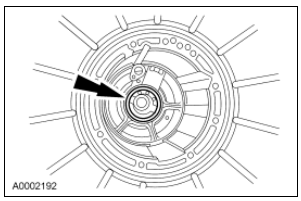
    ⚠ **CAUTION: Make sure the notch opening is not obstructed by the center support retaining ring.**

    Install the center support retaining ring.

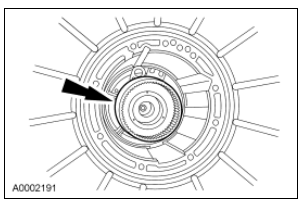
    1. Make sure the center support retaining ring is installed with the tapered side facing up.
    2. Make sure the opening of the center support retaining ring is positioned correctly.



58. Install the center shaft thrust bearing (No. 3).

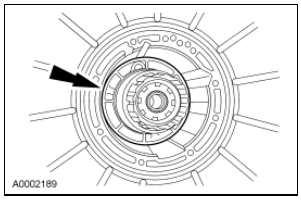


59. Install the overdrive ring gear, overdrive one-way clutch and center shaft assembly.

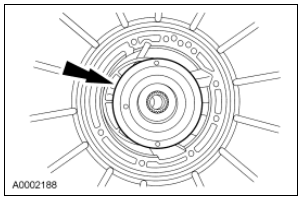


60. ⚠ **CAUTION: Do not bend the trigger wheel. Make sure that the No. 2 thrust bearing is in this assembly.**

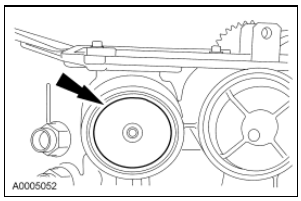
    Install the planetary gear overdrive carrier.



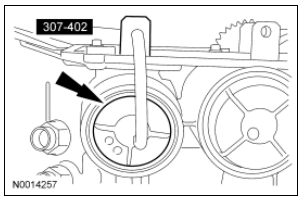
61. Install the overdrive brake drum and coast clutch drum assembly.



62. Install the overdrive band servo piston and spring.
    - Lubricate the servo bore with clean automatic transmission fluid.



63. Using the special tools, install the retaining ring.

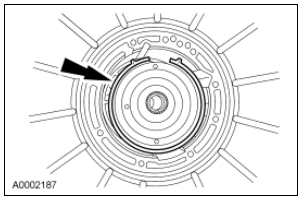


64. **NOTE:** If the overdrive band is reused, it must be installed in the same position as when removed.

    NOTE: Make sure that the overdrive band apply strut is aligned with the band notch.

    NOTE: The new overdrive band is dark in color. This is a normal condition of the band. Hairline cracks in the band are also considered normal. Do not install a new band based solely on the color.

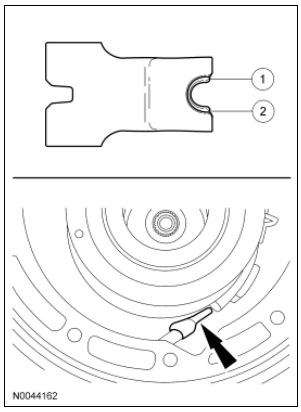
    Install the overdrive band.



65. ⚠ **CAUTION: To avoid a "fall-out" condition of the strut from the screw, during assembly and function, the small "U" shaped notch should be toward the band/case side and the large "U" shaped notch toward the main control side.**

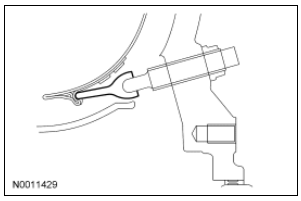
    Install the overdrive band anchor strut.

1. Band/case side of the anchor (small U notch).
2. Main control side of the anchor (large U notch).

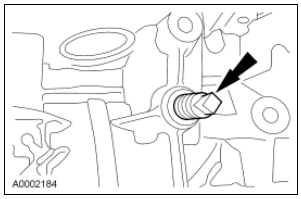


66. ⚠ **CAUTION: If the strut is installed incorrectly, transmission damage will occur.**

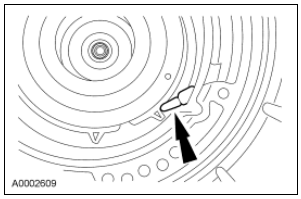
    Check to make sure that the overdrive band anchor strut is installed in the correct orientation to the case and adjustment screw.



67. Loosely install the screw.

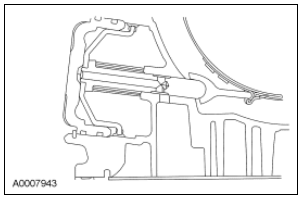


68. Install the overdrive apply strut.



69. ⚠ **CAUTION: If the strut is installed incorrectly, transmission damage will occur.**

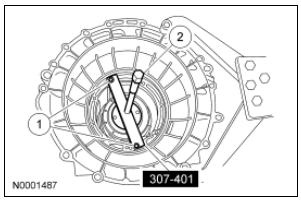
    Check to make sure that the overdrive band apply strut is installed in the correct orientation to the case and piston rod.



70. ⚠ **CAUTION: The torque specifications are critical for this procedure. Failure to use the correct torque specifications may cause transmission damage.**

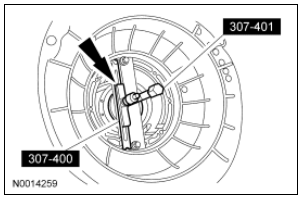
    Install the special tool.

    1. Install the special tool and the bolts using the 2 pump screw locations at approximately 6 and 12 o'clock positions.
        - ♦ Tighten to 15 Nm (11 lb-ft).
    2. Tighten the center screw.
        - ♦ Tighten to 1.13 Nm (10 lb-in).



71. **NOTE:** Align the disc holes on the special tool with the slot in the gauge bar for correct measurement.

    Measure the distance from the top of the gauge bar to the drum bearing surface through the hole in the disc, and record as dimension A. Repeat the measurement 180 degrees on the opposite side of the special tool and record as dimension B.



72. Add dimension A to B, divide by 2, and record as dimension C.

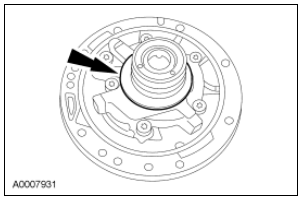
73. Subtract the thickness of the gauge bar 17.78 mm (0.70 in) from dimension C and record as dimension D.

74. Select the No. 1 thrust bearing from the following chart using dimension D.

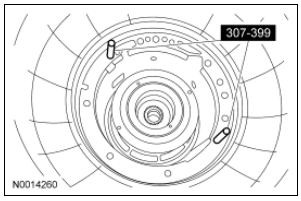
Dimension D	Service Part Number (7D014)	Bearing Thickness	Identification (Color/ID)
38.05-38.13 mm (1.50 in)	F7TZ-TA	1.55-1.60 mm (0.061-0.063 in)	White
38.14-38.28 mm (1.50-1.51 in)	F7TZ-MA	1.75-1.80 mm (0.069-0.071 in)	Green
38.29-38.42 mm (1.51 in)	F7TZ-NA	1.85-1.90 mm (0.073-0.075 in)	Red
38.43-38.61 mm (1.51-1.52 in)	F7TZ-RA	2.05-2.10 mm (0.081-0.083 in)	Black
38.62-38.74 mm	F7TZ-SA	2.15-2.20 mm	Yellow

(1.52-1.53 in)		(0.095-0.097 in)	

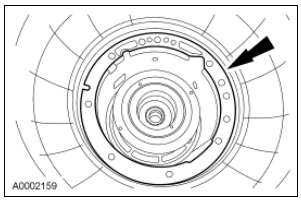
75. Install the selected No. 1 fluid pump input thrust washer.
    - Coat the fluid pump input thrust washer with petroleum jelly.



76. Install the special tools into the transmission case.

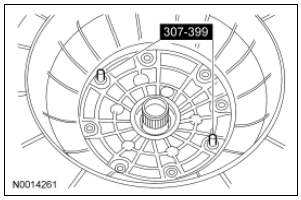


77. Install the pump gasket.



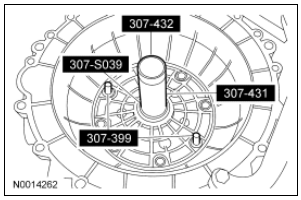
78. ⚠ **CAUTION: Make sure that the fluid pump inlet thrust washer (No. 1), selective thrust washer, fluid pump gasket and the fluid pump-to-case O-ring seal remain in the correct position throughout this step.**

    Install the fluid pump.



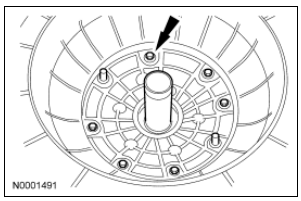
79. ⚠ **CAUTION: The special tools must be used to correctly align the pump with the adapter plate to reduce gear noise, bushing failure and leakage.**

    Using the special tool, align the fluid pump to the adapter plate.

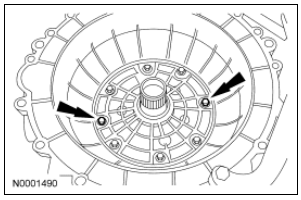


80. Install the screws. Tighten the screws in a star pattern.

- Tighten to 25 Nm (18 lb-ft).



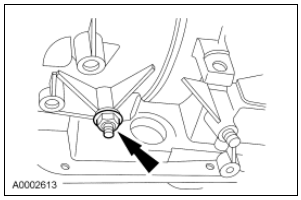
81. Remove the special tools and install the 2 remaining screws.
    - Tighten to 25 Nm (18 lb-ft).



82. **⚠ CAUTION: Do not allow the overdrive band adjustment screw to back out. Band strut could fall out of position.**

    ⚠ CAUTION: Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.

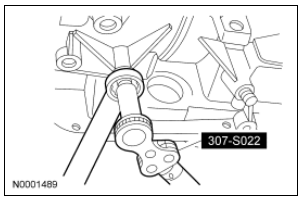
    Install a new locknut on the band adjustment screw.



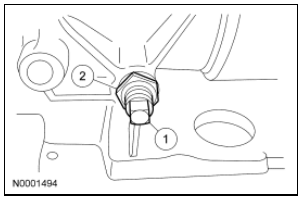
83. **⚠ CAUTION: The overdrive servo must be installed prior to band adjustment.**

    Using the special tool, tighten the overdrive band adjustment screw.

    - Tighten to 14 Nm (10 lb-ft).
    - Then back off the screw exactly 1.5 turns and hold that position.



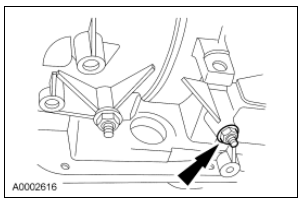
84. Tighten the overdrive band locknut.
    1. Hold the overdrive band adjustment screw stationary.
    2. Tighten the overdrive band locknut.
        - ♦ Tighten to 54 Nm (40 lb-ft).



85. ⚠ **CAUTION: Do not allow the intermediate band adjusting screw to back out. Band strut could fall out of position.**

    ⚠ **CAUTION: Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.**

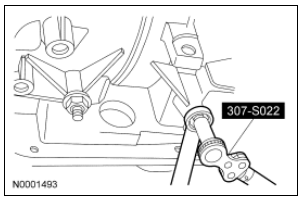
    Install a new nut on the band adjustment screw.



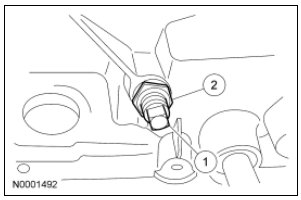
86. ⚠ **CAUTION: The intermediate servo must be installed prior to band adjustment.**

    Using the special tool, tighten the intermediate band adjustment screw.

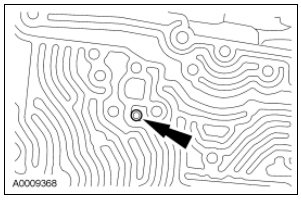
    - Tighten to 14 Nm (10 lb-ft).
    - Then back off the screw exactly 1.5 turns and hold that position.



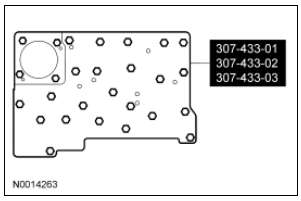
87. Tighten the intermediate band locknut.
    1. Hold the intermediate band adjustment screw stationary.
    2. Tighten the intermediate band locknut.
        - ♦ Tighten to 54 Nm (40 lb-ft).



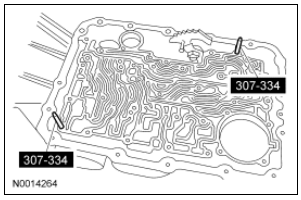
88. Tighten the center support screw.
    - Tighten to 11 Nm (8 lb-ft).



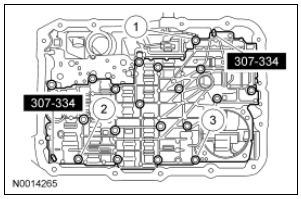
89. Using the special tools, carry out the air pressure test procedure. For additional information, refer to Special Testing Procedures in this section.



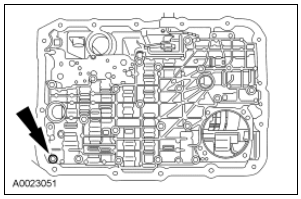
90. Install the special tools into the transmission case.



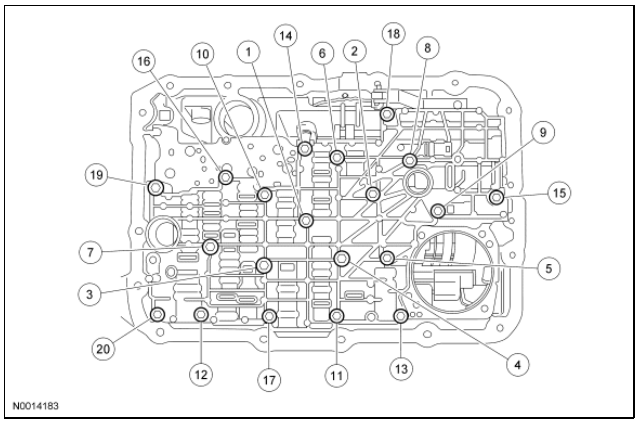
91. Using the special tools, install the main control valve body and loosely install the screws.
    1. Install the short screw.
    2. Install the screw with the larger head.
    3. Install the remaining screws.



92. Remove the special tools, and loosely install the screw.

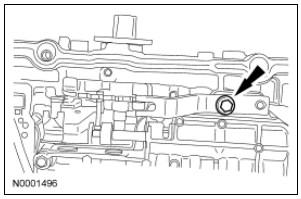


93. Tighten the screws in the sequence shown.
    - Tighten to 10 Nm (89 lb-in).

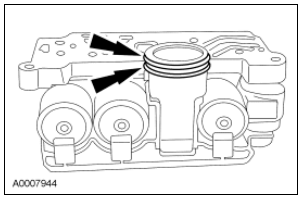


94. With the manual lever in the NEUTRAL position, install the manual valve detent spring.

- Tighten to 10 Nm (89 lb-in).



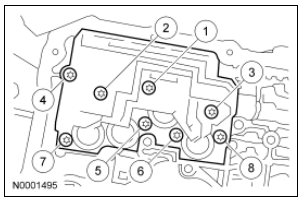
95. Install new O-ring seals on the solenoid body connector. Lubricate the O-ring seals with clean automatic transmission fluid.



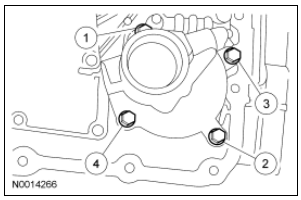
96. ⚠ **CAUTION: Inspect the transmission case bore to make sure it is free of foreign material and not damaged. If damaged, a transmission leak may occur.**

    Install the solenoid body. Tighten the screws in the sequence shown.

    - Tighten to 8 Nm (71 lb-in).



97. Install the reverse servo. Tighten the bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten to 5 Nm (44 lb-in).
    - Stage 2: Tighten to 11 Nm (8 lb-ft).

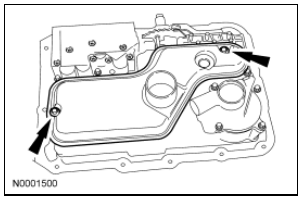


98. ⚠ **CAUTION: Lubricate the fluid filter seals with clean automatic transmission fluid or they may be damaged.**

    NOTE: Make sure that the fluid filter seals are correctly seated on the filter.

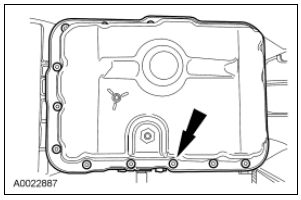
    Lubricate the seals and install the transmission fluid filter.

    - Tighten to 10 Nm (89 lb-in).

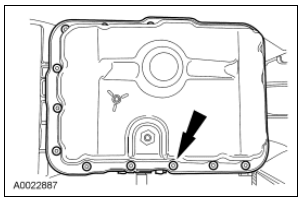


99. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the gasket should be reused.

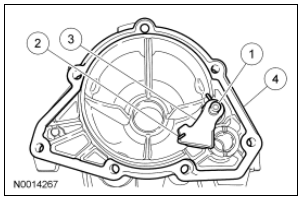
    Install the transmission fluid pan and gasket and loosely install the screws.



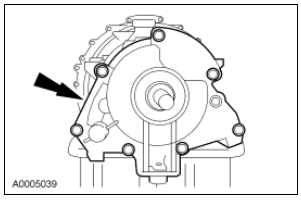
100. Tighten the 16 screws in a crisscross sequence.
    - Tighten to 11 Nm (8 lb-ft).



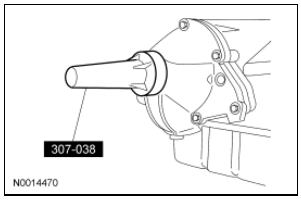
101. Install the parking pawl assembly and gasket.
    1. Install the parking pawl shaft.
    2. Install the parking pawl return spring.
    3. Install the parking pawl.
    4. Install a new gasket.



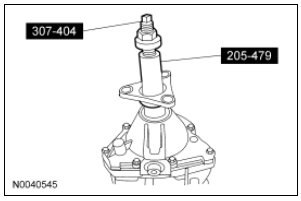
102. Install the extension housing.
    - Tighten to 30 Nm (22 lb-ft).



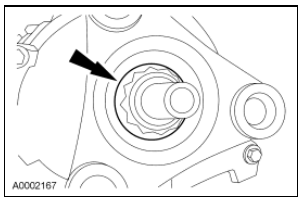
103. Using the special tool, install the extension housing seal.



104. Using the special tools, install the output shaft flange.

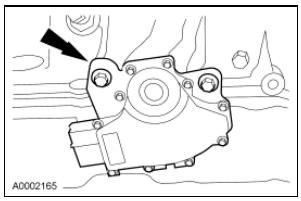


105. Install a new nut.
    - Tighten to 131 Nm (97 lb-ft).



106. ⚠ **CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.**

    Install the digital TR sensor and loosely install the screws.

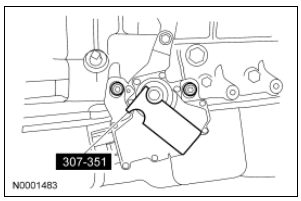


107. ⚠ **CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.**

    NOTE: The manual lever must be in the NEUTRAL position.

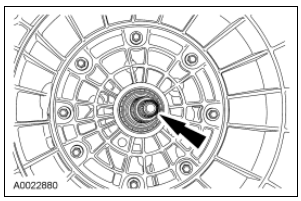
    Using the special tool, align the digital TR sensor and tighten the screws in an alternating sequence.

    - Tighten 8 Nm (71 lb-in).

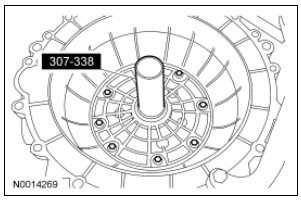


108. ⚠ **CAUTION: The splines of the input shaft are not the same length on both ends. The shaft end with the shorter splines goes into the fluid pump.**

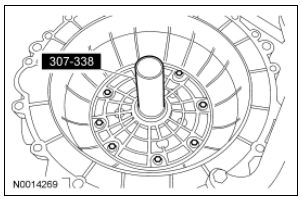
Install the input shaft.



109. Using the special tool, make sure that the fluid pump gear seal ring is fully seated.



110. Remove the special tool.

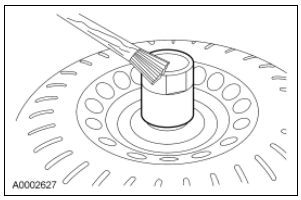


111. ⚠ **CAUTION: Do not damage the fluid pump gear O-ring seal when installing torque converter.**

⚠ **CAUTION: Make sure the converter hub is fully engaged in the pump support and gear and rotates freely. Do not damage the hub seal.**

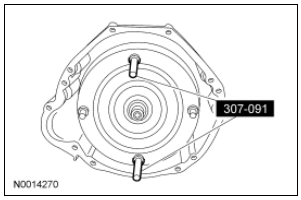
⚠ **CAUTION: If the torque converter slides out, the hub seal may be damaged.**

Lubricate the converter hub with clean automatic transmission fluid.

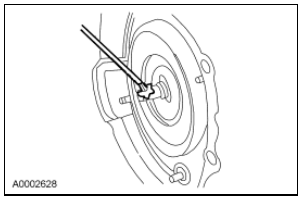


112. ⚠ **WARNING: The torque converter can fall out if the transmission is tipped. Failure to follow these instructions may cause personal injury.**

Using the special tools, install the torque converter by pushing and rotating.



113. Lubricate the torque converter pilot hub with multi-purpose grease.



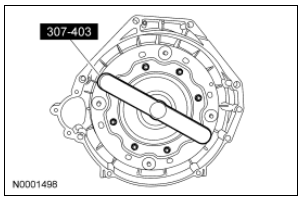
114. ⚠ **CAUTION: The special tool must be used to correctly align the adapter plate to the converter, or transmission damage could occur.**

    In order to correctly install the special service tool, it must be installed using one round and one oblong hole. Using 2 oblong holes will cause damage to the transmission.

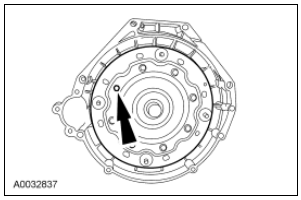
    NOTE: Position the adapter plate on the torque converter and identify the position of the orange or green paint daub on the converter face.

    If the vehicle is equipped, use the special tool to install the torque converter flex plate adapter assembly and 8 nuts.

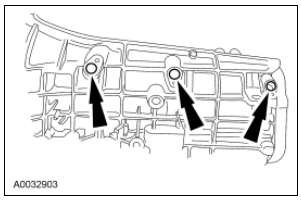
    - Tighten to 40 Nm (30 lb-ft).



115. Remove the special tool and install the remaining torque converter flex plate adapter nuts.
    - Tighten to 40 Nm (30 lb-ft).



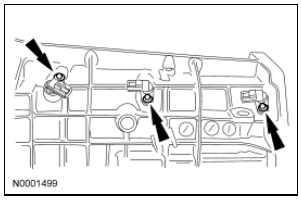
116. Using one of the speed sensor holes, fill the transmission with 8.5L (9 qts) of automatic transmission fluid.



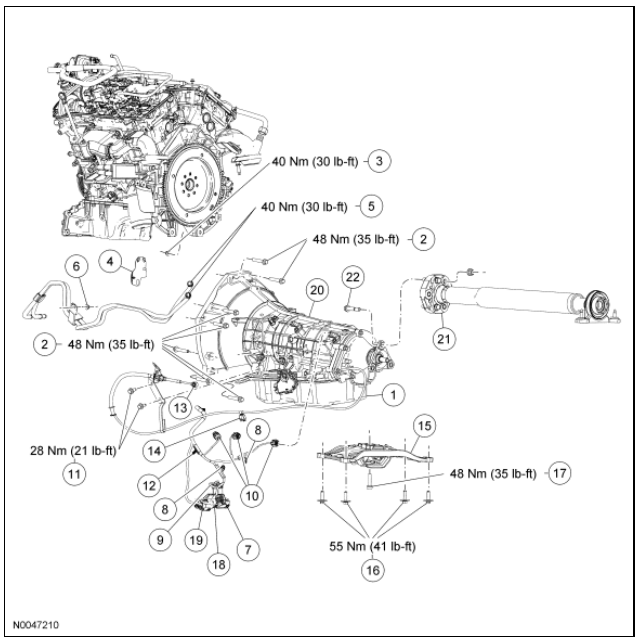
117. **NOTE:** Inspect O-ring seal for damage. Install new if damaged. Lubricate the O-ring seals with petroleum jelly to prevent damage to the O-ring seals.

    Install the sensors.

    - Tighten to 14 Nm (10 lb-ft).


N0001499

Transmission



Item	Part Number	Description
1	7000	Transmission assembly
2	W500120	Transmission-to-engine screws
3	N800750	Torque converter nuts
4	6C070	Torque converter access plug
5	7A030	Fluid cooler tube nuts
6	—	Fluid cooler tube bracket nut (part of 7A030)
7	14A464	Digital transmission range (TR) sensor electrical connector
8	14A464	Wire harness retainers
9	7C078	Solenoid body harness connector
10	14A464	Speed sensor connectors
11	N605918	Shift cable bracket and screws
12	14A464	Wire harness retainer
13	7E395	Shift cable eyelet
14	7E395	Shift cable retainer
15	6A023	Transmission support
16	W704971	Transmission crossmember-to-floor pan screws
17	W705966	Transmission insulator-to-extension housing center screw
18	9F472	Heated oxygen sensor electrical connector retainer (part of 9F472)
19	9F472	Heated oxygen sensor electrical connector (part of 9F427)

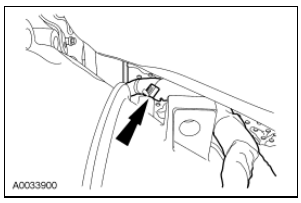
20	7005	Transmission assembly
21	—	Output shaft flange coupler
22	—	Transmission output shaft flange coupler bolts

1. ⚠ **WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions can result in personal injury.**

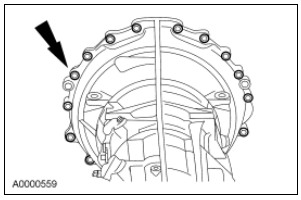
   Secure the transmission to the transmission jack with a safety chain.

2. **NOTE:** Rotate the torque converter so that the torque converter paint mark is in the 12 o'clock position.

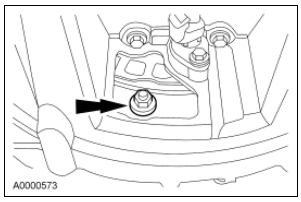
   While raising and positioning the transmission to the engine, install the wire harness to the top of the transmission.



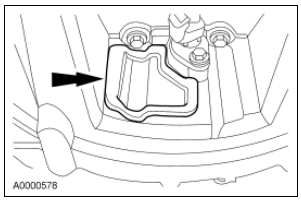
3. Carefully position the transmission in alignment with the engine and install the transmission-to-engine screws.
   - Tighten to 48 Nm (35 lb-ft).



4. Install the torque converter nuts.
   - Tighten to 40 Nm (30 lb-ft).



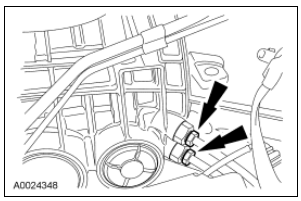
5. Install the converter access cover.



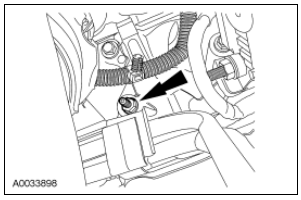
6. ⚠ **CAUTION: Do not damage the cooler tubes. Hold the transmission case fitting with a wrench.**

   Connect the transmission cooler tubes.

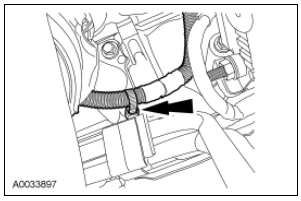
- Tighten to 40 Nm (30 lb-ft).



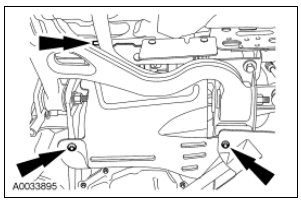
7. Install the cooler line bracket.
   - Tighten to 18 Nm (13 lb-ft).



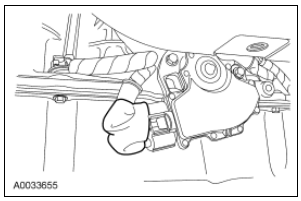
8. Connect the wire harness to the cooler line bracket.



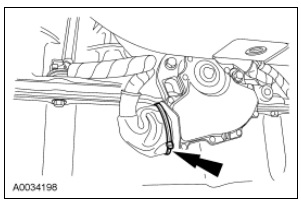
9. Install the splash shield, then install the screws and pushpin.



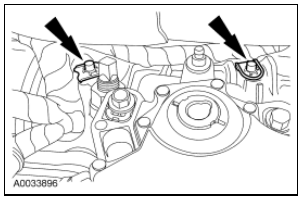
10. Reconnect the digital transmission range TR sensor connector.



11. Slide the boot over the digital TR sensor connector and install a new tie strap.



12. Connect the wire harness retainers to the transmission.



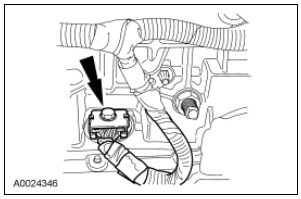
13. ⚠ **CAUTION: Damage will occur to the solenoid body assembly if the screw is tightened above the specification.**

    NOTE: Always install new O-ring seals on the vehicle harness connector.

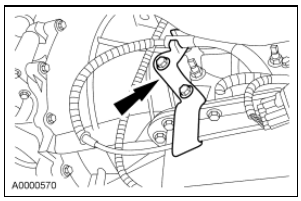
    NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

    Install and lubricate new O-ring seals on the transmission connector and connect the connector.

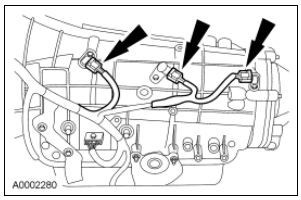
    - Tighten to 5 Nm (44 lb-in).



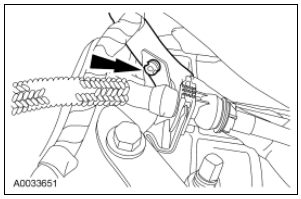
14. Install the shift cable bracket screws and bracket.
    - Tighten to 27 Nm (20 lb-ft).



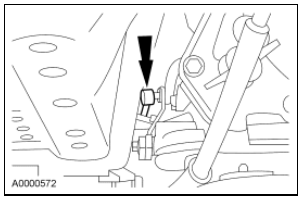
15. Connect the turbine shaft speed (TSS), output shaft speed (OSS) and intermediate shaft speed sensor electrical connectors.



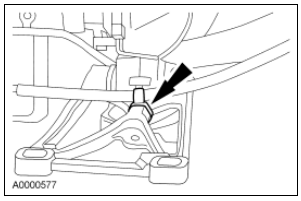
16. Install the wire harness to the top of the transmission shift cable bracket.



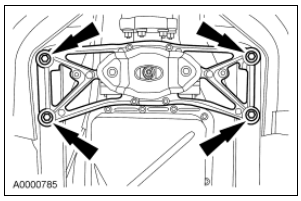
17. Connect the transmission shift cable eyelet to the manual lever.



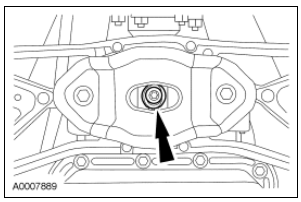
18. Install the shift cable to the rear transmission support.



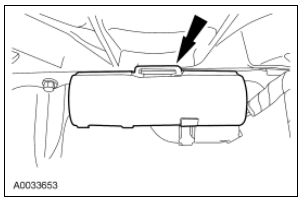
19. Position the rear transmission crossmember and install the transmission crossmember-to-floor pan screws.
    - Tighten to 55 Nm (41 lb-ft).



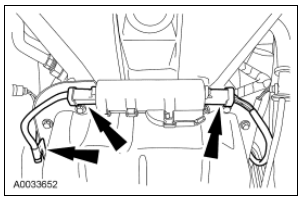
20. Install the transmission insulator-to-extension housing center screw.
    - Tighten to 48 Nm (35 lb-ft).



21. Install the heated oxygen sensor (HO2S) connector to the front of the transmission pan rail.



22. Connect the HO2S connector and install the sensor wire retaining clip to the RH side of the transmission pan rail.



23. Install the driveshaft. For additional information, refer to Section 205-01 .

24. Install the exhaust system and front heat shields. For additional information, refer to Section 309-00 .

25. Use the following guidelines for the in-line transmission fluid filter:
    - If the transmission was overhauled and the vehicle was equipped with an in-line fluid filter, install a new in-line fluid filter.
    - If the transmission was overhauled and the vehicle was not equipped with an in-line fluid filter, install a new in-line fluid filter kit.
    - If the transmission is being installed for a non-internal repair, do not install an in-line filter or filter kit.
    - If installing a new or a Ford-authorized remanufactured transmission, install the in-line transmission fluid filter that is supplied.
      Prior to lowering the vehicle, install a new in-line transmission filter or a filter kit. For additional information, refer to Transmission Fluid In-Line Filter in this section.

26. **NOTE:** When the battery has been disconnected and reconnected, some abnormal drive symptoms can occur while the vehicle relearns its adaptive strategy. The customer needs to be notified that they can experience slightly different upshifts (either soft or firm) and that this is a temporary condition and will eventually return to normal operating condition.

    Connect the battery ground cable. For additional information, refer to Section 414-01 .

27. Carry out the fluid level check. For additional information, refer to Transmission Fluid Level Check in this section.

28. Verify that the shift cable is correctly adjusted. For additional information, refer to Section 307-05 in this section.

29. Check the operation of the transmission and inspect for leaks.

General Specifications

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Torque Specifications

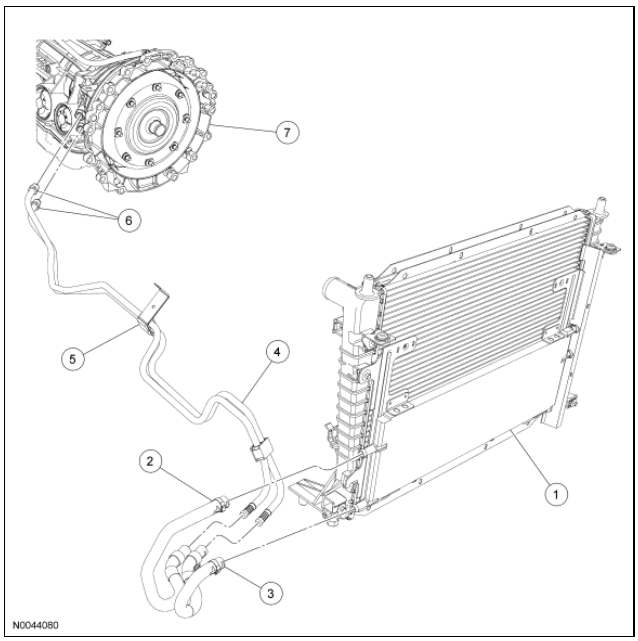
Description	Nm	lb-ft	lb-in
Bolt retaining the transmission fluid cooler to the radiator	10	—	89
Nut retaining the fluid cooler tube bracket to the stud	18	13	—
Nut retaining the fluid cooler tube to the transmission	40	30	—

Transmission Cooling

The transmission fluid cooler is an oil-to-air (OTA) fluid cooler. The fluid cooler is mounted between the radiator and the A/C condenser.

- When the transmission fluid is cold and the thermostatic valve is closed, the transmission fluid does not circulate through the fluid cooler.
- As the transmission fluid temperature increases, the thermostatic bypass valve opens and allows the transmission fluid to circulate through the fluid cooler.

Transmission Fluid Cooler Tubes



Item	Part Number	Description
1	7H189	Transmission fluid cooler
2	7A030	Transmission fluid cooler inlet hose
3	7A031A	Transmission fluid cooler outlet tube
4	7A031B	Transmission fluid cooler tubes
5	—	Transmission fluid cooler tube bracket
6	—	Fluid cooler tube assembly nuts
7	7005	Transmission case

Transmission Cooling

⚠ CAUTION: Whenever a transmission has been disassembled to install new parts, a new transmission fluid cooler must be installed and the transmission fluid cooler tubes must be cleaned and backflushed.

NOTE: Cleaning and backflushing the transmission fluid cooling system, along with normal cleaning and inspection procedures as outlined in this section during disassembly and reassembly, will keep contamination from re-entering the transmission and causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission troubles and must be removed from the system before the transmission is put back in use.

Inspection and Verification

When fluid leakage is found in the fluid cooler, install a new fluid cooler.

When there is evidence of transmission assembly or fluid contamination due to the following transmission failure modes, install a new fluid cooler.

- Major metallic failure
- Multiple clutches or clutch plate failure
- Sufficient component wear which results in metallic contamination

Symptom Chart

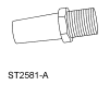
Symptom Chart

Transmission Fluid Cooler Backflushing and Cleaning

1. Refer to Section 307-01 .

Transmission Fluid Cooler Flow Test

Special Tool(s)

 ST2581-A	Transmission Fluid Fill Tool 307-437

Material

Item	Specification
MERCONï¿½ V Automatic Transmission Fluid XT-5-QM	MERCONï¿½ V

⚠ CAUTION: Whenever a transmission has been disassembled to install new parts or a new or remanufactured transmission has been installed, a new transmission fluid cooler (either in-tank, auxiliary or OTA) if equipped, will need to be installed. Using a suitable torque converter/fluid cooler cleaner, clean and backflush the transmission fluid cooler tubes.

⚠ CAUTION: Use only clean automatic transmission fluid specified for this transmission. Do not use supplemental fluid additives, treatments or cleaning agents. The use of these materials may affect transmission operation and result in internal damage to the transmission.

⚠ CAUTION: When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the transmission fluid cooler. These contaminants are a major cause of recurring transmission concerns and must be removed from the system before the transmission is put back into use.

When evidence of transmission fluid contamination (such as metal particles, clutch plate material or band material) is found in the cooling system, the transmission fluid cooler flow test should be carried out.

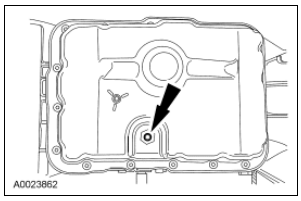
If the transmission cooling system fails the transmission fluid cooler flow test, install a new transmission fluid cooler and flush out the fluid cooler lines. If installing a new transmission fluid cooler, use only factory approved components.

NOTE: The engine idle, transmission linkage/cable adjustment, fluid level and line pressure must be within specification before carrying out this test. Refer to Section 307-05 for adjustments. For additional information on engine idle diagnosis, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. For additional information on fluid level check, refer to Section 307-01 . For additional information on line pressure, refer to Section 307-01 .

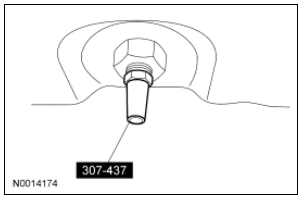
1. Place the transmission range selector lever into PARK.

2. Raise the vehicle on a hoist and place suitable safety stands under the vehicle. For additional information, refer to Section 100-02 .

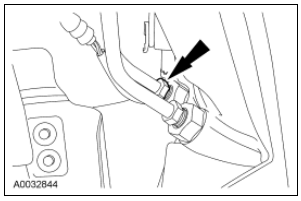
3. Hold the large drain plug with a wrench, and remove the small (center) fluid level indicating plug using a 3/16-inch Allen key.



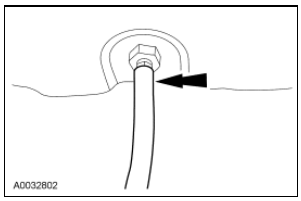
4. Install the special tool into the pan.



5. Remove the cooler return line (upper line) from the fitting on the transmission case.



6. Connect one end of a clear hose to the cooler return line and route the other end of the hose to the special tool in the pan.



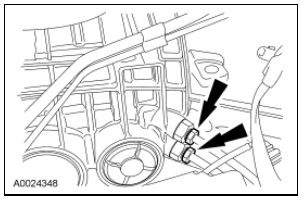
7. Remove the safety stands and lower the vehicle.

8. Start the engine and run it at idle.

9. With the engine running, raise the vehicle on a hoist and place suitable safety stands under the vehicle. For additional information, refer to Section 100-02 .

10. Once a steady flow of fluid (without air bubbles) is observed, remove the hose from the special tool and place the hose in a measuring container for 15 seconds. After 15 seconds, place the hose back onto the special tool. Lower the vehicle and turn the engine OFF. Measure the amount of fluid in the container. If adequate flow was observed, approximately 208 ml (7 oz) will be in the measuring container. The test is complete. Reconnect the cooler line and install the fluid fill plug.

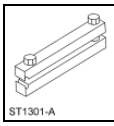
11. If the flow is not liberal, disconnect the hose from the cooler return line and connect the hose to the cooler inlet (lower fitting) on the transmission case. Reconnect the cooler return line to the case (upper fitting).
    - Tighten to 40 Nm (30 lb-ft).

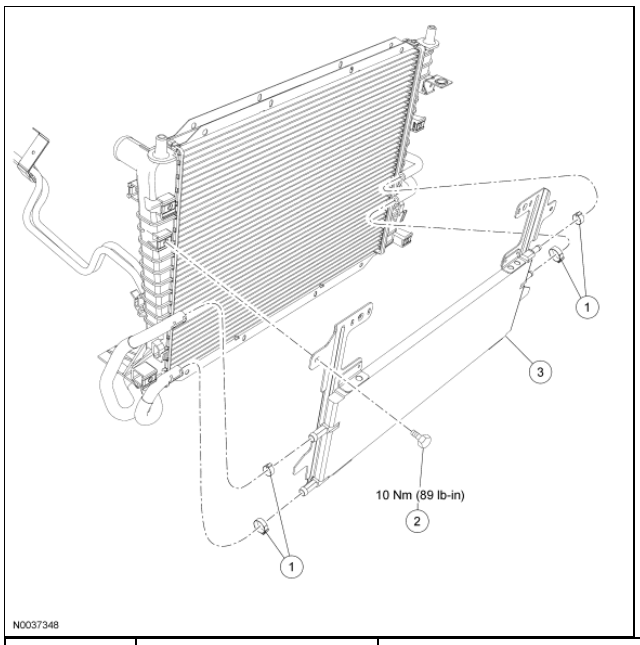


12. Repeat Steps 8 through 10. If flow is now approximately 208 ml (7 oz) in 15 seconds, the cooler lines and auxiliary cooler must be cleaned. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section. Carry out this entire test after the backflushing and cleaning procedure. If, after carrying out the backflushing and cleaning procedure, the flow is still not adequate, new cooler lines and/or an auxiliary cooler must be installed. If the flow from the case is still not adequate after the installation of new cooler lines and/or an auxiliary cooler (208 ml [7 oz] in 15 seconds), the pump and/or torque converter may be at fault. Carry out the appropriate procedures for diagnosis and repair in this section.

Combination Fluid Cooler

Special Tool(s)

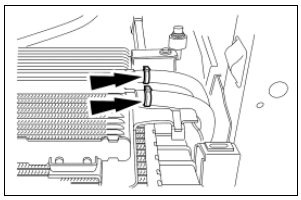
 ST1301-A	Installer, Constant Velocity Joint Boot Clamp 205-343 (T95P-3514-A)



Item	Part Number	Description
1	376240	Transmission fluid cooler hose clamps
2	N606676	Transmission fluid cooler bolt
3	7H189	Transmission fluid cooler

Removal

1. Remove the A/C condenser core. For additional information, refer to Section 412-01 .
2. Remove and discard the 4 hose clamps.

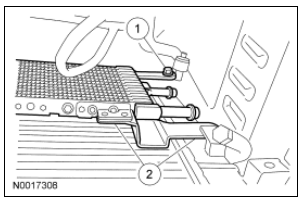


3. **NOTE:** Position a drain pan under the vehicle to catch any fluid that may spill.

   Disconnect the 4 hoses from the cooler. Plug the hoses and the cooler.

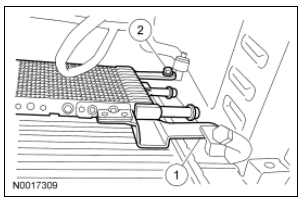
4. Remove the cooler.
   1. Remove the 2 bolts.

2. Lift the cooler from the retainers and remove the cooler.



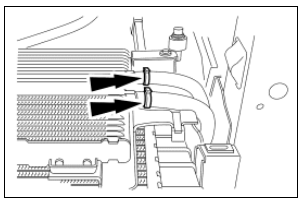
Installation

1. Install the cooler.
    1. Position the cooler on the retainers.
    2. Install the 2 bolts.
        - Tighten to 10 Nm (89 lb-in).

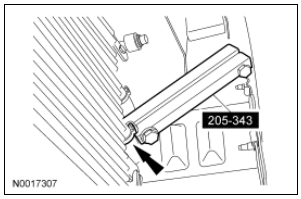


2. Position new hose clamps on the 4 hoses.

3. Remove the plugs from the 4 hoses and the cooler. Connect the 4 hoses to the cooler.



4. Using the special tool, tighten the 4 hose clamps.



5. Install the A/C condenser. For additional information, refer to Section 412-01 .

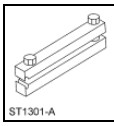
6. Fill and leak check the power steering system. For additional information, refer to Section 211-00 .

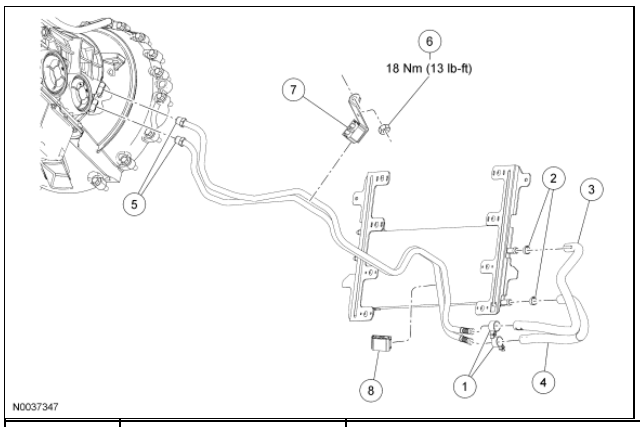
7. Fill and leak check the cooling fan system. For additional information, refer to Section 303-03 .

8. Fill the automatic transmission and leak check the cooling system. For additional information, refer to Section 307-01 .

Transmission Fluid Cooler Tubes

Special Tool(s)

 ST1301-A	Installer, Constant Velocity Joint Boot Clamp 205-343 (T95P-3514-A)



Item	Part Number	Description
1	376240	Transmission fluid cooler hose clamps
2	376240	Transmission fluid cooler hose clamps
3	7A030	Transmission fluid cooler inlet hose
4	7A031A	Transmission fluid cooler outlet hose
5	7A031B	Transmission fluid cooler tubes
6	—	Transmission fluid cooler tube bracket nut
7	—	Transmission fluid cooler tube bracket
8	—	Transmission fluid cooler tube retainer

Removal

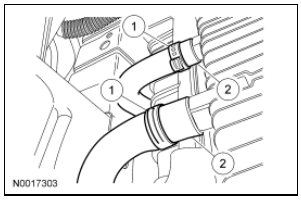
NOTE: This procedure describes the removal and installation of all the transmission cooling system tubes and hoses. Only disconnect those that require removal from the vehicle.

Hose removal

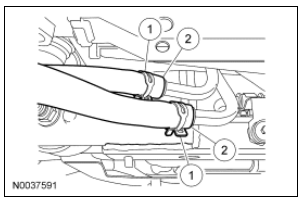
NOTE: Proceed to Disconnecting the tubes in this section if only removing the transmission fluid cooler tubes from the vehicle.

1. Remove the A/C condenser core. For additional information, refer to Section 412-01 .

2. Disconnect the transmission fluid cooler hose from the cooler.
    1. Cut and discard the clamp.
    2. Disconnect the transmission fluid cooler hose from the cooler.



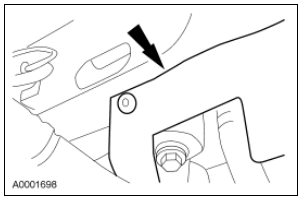
3. Disconnect the transmission fluid cooler hose from the transmission fluid cooler tube.
    1. Open and position the clamp aside.
    2. Disconnect the transmission fluid cooler hose from the transmission fluid cooler tube.
        - Proceed to Hose installation in this section if not removing the transmission fluid cooler tubes from the vehicle. Otherwise, proceed as follows.



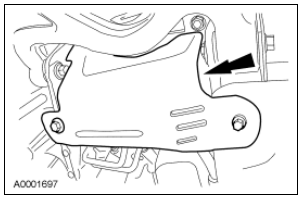
Disconnecting the tubes

4. If not done previously, raise and support the vehicle. For additional information, refer to Section 100-02 .

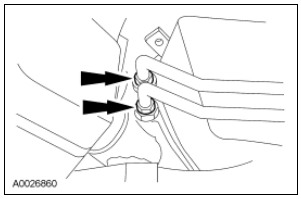
5. If not done previously, remove the LH splash shield pushpin.



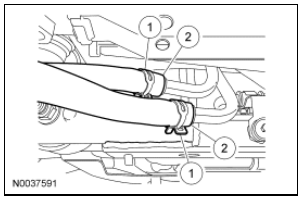
6. If not done previously, remove the bolts and the LH splash shield.



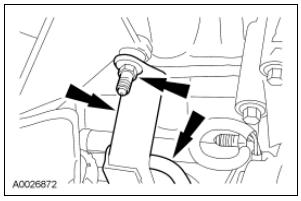
7. Disconnect the transmission fluid cooler tubes from the transmission.



8. If not done previously, disconnect the transmission fluid cooler hoses from the transmission fluid cooler tubes.
    1. Open and position the clamps aside.
    2. Disconnect the transmission fluid cooler hoses from the transmission fluid cooler tubes.

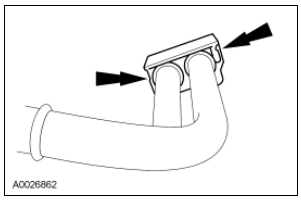


9. Remove the nut, fluid cooler tube bracket and fluid cooler tubes.



Routing bracket removal

10. Remove the fluid cooler tube routing bracket from the fluid cooler tubes.

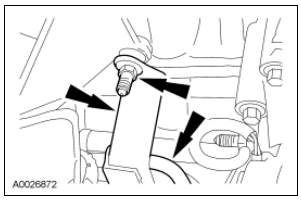


Installation

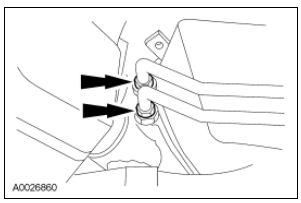
NOTE: Proceed to Hose installation in this section if the transmission fluid cooler tubes were not removed from the vehicle.

Connecting the tubes

1. Position the transmission fluid cooler tubes and the fluid cooler tube bracket, and install the nut.
   - Tighten to 18 Nm (13 lb-ft).

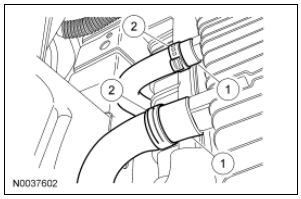


2. Connect the transmission fluid cooler tubes to the transmission.
   - Tighten to 40 Nm (30 lb-ft).
   - Proceed to Connecting the hose(s) in this section if the transmission fluid cooler hoses were not removed from the vehicle. Otherwise, proceed as follows.

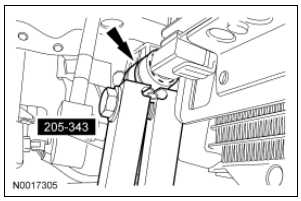


Hose installation

3. Connect the transmission fluid cooler hose(s) to the cooler.
    1. Connect the transmission fluid cooler hose to the cooler.
    2. Position the clamp on the transmission fluid cooler hose.

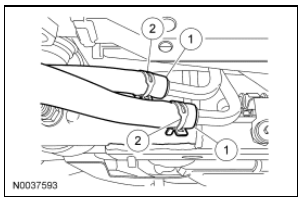


4. Using the special tool, tighten the clamp.
    - Repeat this step for the other hose clamp, if removed.



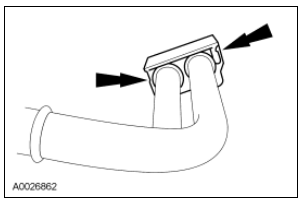
Connecting the hose(s)

5. Connect the transmission fluid cooler hose to the transmission fluid cooler tube.
    1. Push the transmission fluid cooler hose onto the transmission fluid cooler tube until bottomed against the stop.
    2. Install the clamp.



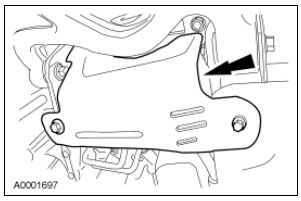
Final assembly

6. If removed, install the fluid cooler tube routing bracket.

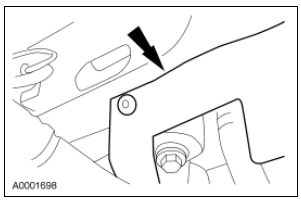


7. If removed, install the A/C condenser core. For additional information, refer to Section 412-01 .

8. Install the LH splash shield and the bolts.



9. Install the LH splash shield pushpin.



10. Lower the vehicle.

11. Fill the automatic transmission and leak check the cooling system. For additional information, refer to Section 307-01 .

Torque Specifications

Description	Nm	lb-ft	lb-in
Shifter assembly bolts	7	—	62
Shift lock actuator bolts	9	—	80
Transmission shift cable and bracket bolts	28	21	—
Screws retaining heat shield	10	—	89

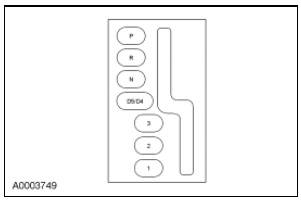
External Controls

The transmission shift cable transfers the transmission operating mode from the transmission range selector lever to the automatic transmission. For additional information, refer to Section 307-01 . The indicated position of the lever is transferred to the transmission through the cable and down to the manual control lever on the transmission. For additional information, refer to Section 307-01 .

Depending on the vehicle options selected the lever may have different range positions.

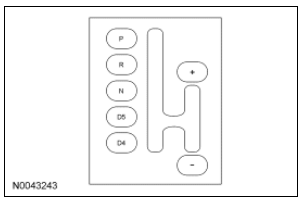
The standard lever has 8 positions: P, R, N, D5, D4, 3, 2, and 1.

Base Range Shifter



The optional select shift transmission (SST) range selector lever has 7 positions P, R, N, D5, or D4, + and -. The + and - option will allow the driver to manually upshift and downshift into any gear range.

Optional Range Shifter



Brake Shift Interlock System

The shift interlock system prevents shifting the transmission out of the PARK position unless the brake pedal is depressed. The shift interlock system consists of a shift lock actuator mounted on the ignition switch. The actuator is energized when the ignition switch is turned to RUN, locking the transmission range selector lever in the PARK position. When the brake pedal is applied and the brake pedal position (BPP) switch activated, the shift lock actuator is deactivated, allowing the selector lever to move out of the PARK position.

The ignition shift interlock cable locks the selector lever in the PARK position when the ignition switch is in the lock position. It also requires the selector lever to be in the PARK position in order to turn the ignition switch to the lock position.

Select Shift Transmission (SST) Switches (+ and -)

The positions indicated by a (+) or a (-) allow the driver to manually select the appropriate upshift (+) or downshift (-) and gear range.

The SST switches are located within the transmission range selector assembly and are momentary contact switches that send a signal to the powertrain control module (PCM) each time the driver moves the selector

lever into the upshift or downshift gear range.

The PCM uses the input signals from the SST+ and the SST- switches, along with other vehicle inputs, to determine which gear should be commanded.

Transmission Control Switch (TCS)

The TCS is a momentary contact switch that sends a signal to the PCM when the driver selects the D4 position, canceling operation of 5TH (overdrive) gear.

The TCS is located within the range selector assembly for the base shifter only.

The PCM uses this signal to control the shift solenoids to disengage/disable 5TH gear operation and activates coast clutch for the base shifter only. At the same time the PCM changes the instrument panel indicator to display D4.

When the driver moves the selector lever back to the D5 position, 5TH gear operation is enabled, the coast clutch is released and the instrument panel indicator displays D5.

Park Sense Switch

The park sense switch prevents the redundant PRNDL from displaying "P" until the shifter is in the PARK position.

Electronic Transmission Error Indicator

The vehicle is equipped with a redundant electronic gearshift indicator. This character appears with the key in the RUN position and displays the same gear selection as shown on the selector lever floor console next to the range selector lever. If an "E" character flashes or remains on this indicates that a transmission malfunction has occurred.

External Controls

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Inspection and Verification

1. Verify the customer concern by operating the transmission external control.
2. Visually inspect for obvious signs of mechanical and electrical damage; refer to the following charts:

Visual Inspection Chart

Mechanical	Electrical
• Shift lock actuator • Transmission control switch • SST (+/-) switches • Shift cable and bracket • Park sense switch	• Central junction box (CJB) fuse: ♦ 204 (5A) ♦ 205 (5A) • Damaged wiring harness • Loose or corroded connections • Powertrain control module (PCM)

Diagnostic Trouble Code Chart

Five Digit DTC	Component	Description	Condition	Symptom	Action
P0815	SST +/-	SST +/- Circuit Input Signal Failed	PCM has detected an incorrect voltage SST input.	May not be able to shift in manual mode.	GO to Pinpoint Test C .
P1780	TCS	TCS Input Incorrect Per Selected Position	TCS voltage incorrect.	No overdrive cancel when range selector is moved.	GO to Pinpoint Test A .

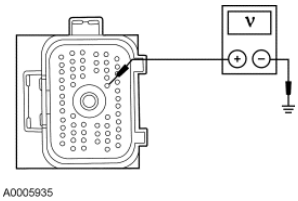
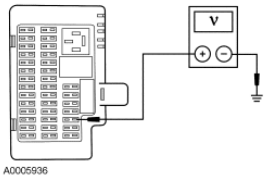
3. If the concern is not visually evident, determine the symptom. GO to Symptom Chart .

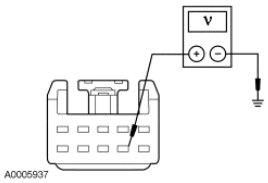
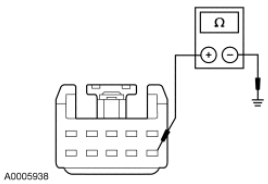
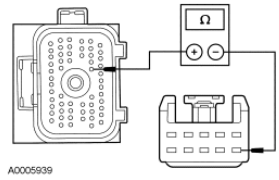
Symptom Chart

Symptom Chart

Pinpoint Tests

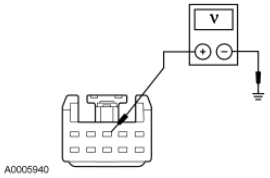
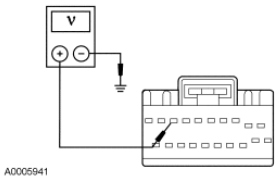
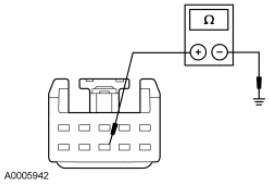
PINPOINT TEST A: OVERDRIVE CANCEL SWITCH IS INOPERATIVE

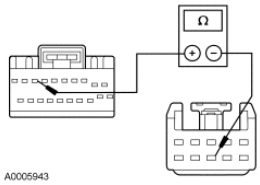
Test Step	Result / Action to Take
A1 CHECK INPUT TO PCM	
• Ignition OFF. • Disconnect: PCM C175B. • Ignition ON. • Measure the voltage between PCM C175B pin 41, circuit 8-TA21 (WH/GN), harness side and ground.  A0005935 • **Is the voltage greater than 10 volts?**	**Yes** REFER to Section 413-01 . **No** GO to A2 .
A2 CHECK FOR VOLTAGE TO FUSE 205 (5A)	
• Ignition ON. • Measure the voltage between primary junction box fuse 205 (5A) input pin and ground.  A0005936 • **Is the voltage greater than 10 volts?**	**Yes** GO to A3 . **No** REPAIR the circuit. TEST the system for normal operation.
A3 CHECK FOR VOLTAGE INPUT TO THE SHIFTER	
• Ignition OFF. • Disconnect: Transmission Shift Selector C307. • Ignition ON. • Measure the voltage between transmission shift selector C307 pin 7, circuit 20-TA21 (PK/BK), harness side and ground.	**Yes** GO to A4 . **No** REPAIR circuit 20-TA21 (PK/BK). TEST the system for normal operation.

 A0005937 • **Is the voltage greater than 10 volts?**	
A4 CHECK CIRCUIT 8-TA21 (WH/GN) FOR SHORT TO GROUND	
• Disconnect: PCM C175B. • Disconnect: Transmission Shift Selector C307. • Measure the resistance between transmission shift selector C307 pin 6, circuit 8-TA21 (WH/GN), harness side and ground.  A0005938 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A5 . **No** REPAIR the circuit. TEST the system for normal operation.
A5 CHECK CIRCUIT 8-TA21 (WH/GN) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between PCM C175B pin 41, circuit 8-TA21 (WH/GN), harness side and transmission shift selector C307 pin 6, circuit 8-TA21 (WH/GN), harness side.  A0005939 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new shifter harness. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

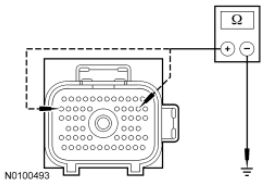
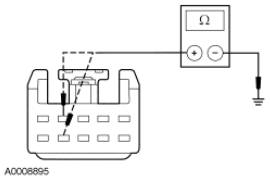
PINPOINT TEST B: THE PARK SWITCH IS INOPERATIVE

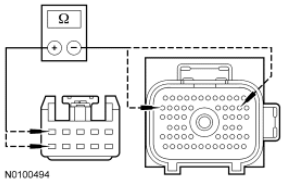
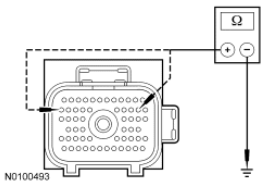
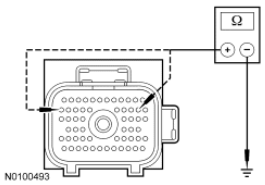
Test Step	Result / Action to Take
B1 CHECK CIRCUIT 15-TA34 (GN/YE) FOR OPEN	
• Disconnect: Transmission Shift Selector C307. • Ignition ON. • Measure the voltage between transmission shift selector C307 pin 3, circuit 15-TA34 (GN/YE), harness side and ground.	**Yes** GO to B2 . **No** REPAIR the circuit. TEST the system for normal operation.

 A0005940 • **Is the voltage greater than 10 volts?**	
B2 CHECK FOR VOLTAGE ON CIRCUIT 8-TA34 (WH)	
• Connect: Transmission Shift Selector C307. • Disconnect: Instrument Cluster C220b. • Select PARK. • Ignition ON. • Measure the voltage between instrument cluster C220b pin 8, circuit 8-TA34 (WH), harness side and ground.  A0005941 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** GO to B3 .
B3 CHECK CIRCUIT 8-TA34 (WH) FOR SHORT TO GROUND	
• Ignition OFF. • Disconnect: Transmission Shift Selector C307. • Measure the resistance between transmission shift selector C307 pin 8, circuit 8-TA34 (WH), harness side and ground.  A0005942 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B4 . **No** REPAIR the circuit. TEST the system for normal operation.
B4 CHECK CIRCUIT 8-TA34 (WH) FOR OPEN	
• Measure the resistance between transmission shift selector C307 pin 8, circuit 8-TA34 (WH), harness side and instrument cluster C220b pin 8, circuit 8-TA34 (WH), harness side.	**Yes** INSTALL a new shifter harness. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

 A0005943 • **Is the resistance less than 5 ohms?**	

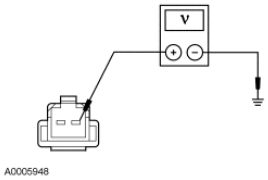
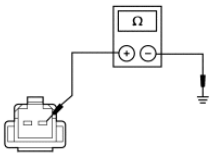
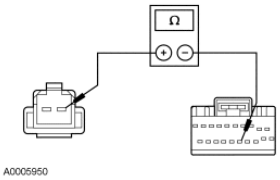
PINPOINT TEST C: THE TRANSMISSION MANUAL SHIFT (+/-) IS INOPERATIVE

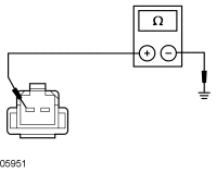
Test Step	Result / Action to Take
C1 CHECK CIRCUITS 8-TA67 (WH/VT) AND 8-TA68 (WH/BK) INPUT TO THE PCM	
• Disconnect: PCM C175B. • Measure the resistance between PCM C175B pin 14, circuit 8-TA67 (WH/VT), harness side and ground; and between PCM C175B pin 22, circuit 8-TA68 (WH/BK), harness side and ground, while activating the shifter to the manual UP and DOWN position.  N0100493 • **Are the resistances less than 5 ohms?**	**Yes** GO to C4 . **No** GO to C2 .
C2 CHECK TRANSMISSION SHIFT SELECTOR CIRCUITS 31-TA67 (BK/WH) AND 31-TA68 (BK/RD) FOR OPEN	
• Disconnect: Transmission Shift Selector 307. • Measure the resistance between transmission shift selector C307 pin 9, circuit 31-TA67 (BK/WH), harness side and ground; and between shifter C307 pin 4, circuit 31-TA68 (BK/RD), harness side and ground.  A0008895 • **Are the resistances less than 5 ohms?**	**Yes** GO to C3 . **No** REPAIR the circuits. TEST the system for normal operation.
C3 CHECK CIRCUITS 8-TA67 (WH/VT) AND 8-TA68 (WH/BK) FOR OPEN	
• Measure the resistance between shifter C307 pin 10, circuit 8-TA67 (WH/VT), harness side and PCM C175B pin 14, circuit 8-TA67 (WH/VT) harness side; and C307 pin 5, circuit 8-TA68 (WH/BK), harness side, and PCM C175B pin 22, circuit 8-TA68 (WH/BK), harness side.	**Yes** INSTALL a new shifter harness. TEST the system for normal operation.

 • **Are the resistances less than 5 ohms?**	**No** REPAIR the circuits. TEST the system for normal operation.
C4 CHECK CIRCUITS 8-TA67 (WH/VT) AND 8-TA68 (WH/BK) FOR SHORT TO GROUND	
• Disconnect: Shifter C307. • Measure the resistance between PCM C175B pin 14, circuit 8-TA67 (WH/VT), harness side and ground; and between PCM C175B pin 22, circuit 8-TA68 (WH/BK), harness side and ground.  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to C5 . **No** REPAIR the circuit. TEST system for normal operation.
C5 CHECK THE TRANSMISSION SHIFT SELECTOR SWITCHES	
• Connect: Transmission Shift Selector C307. • Measure the resistance between PCM C175B pin 14, circuit 8-TA67 (WH/VT), harness side and ground; and between PCM C175B pin 22, circuit 8-TA68 (WH/BK), harness side and ground while activating the manual UP and DOWN position.  • **Is the resistance less than 5 ohms with the switch on and greater than 10,000 ohms with the switch off?**	**Yes** INSTALL a new PCM. **No** INSTALL a new harness. TEST the system for normal operation.

PINPOINT TEST D: BRAKE SHIFT INTERLOCK INOPERATIVE

Test Step	Result / Action to Take
D1 CHECK FOR FEM DTCs	
• Retrieve FEM DTCs. Refer to Section 417-01 . • **Are any DTCs retrieved related to the brake switch?**	**Yes** REFER to Section 417-01 . **No** GO to D2 .

D2 CHECK FOR VOLTAGE ON CIRCUIT 7S-TA33 (YE/VT)	
• Ignition OFF. • Disconnect: Brake Shift Interlock C322. • Ignition ON. • Press and hold the brake pedal. • Measure the voltage between brake shift interlock C322 pin 2, circuit 7S-TA33 (YE/VT), harness side and ground.  A0005948 • **Is the voltage greater than 10 volts?**	**Yes** GO to D5 . **No** GO to D3 .
D3 CHECK CIRCUIT 75-TA33 (YE/VT) FOR SHORT TO GROUND	
• Disconnect: FEM C201f. • Measure the resistance between brake shift interlock C322 pin 2, circuit 7S-TA33 (YE/VT), harness side and ground.  A0005949 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D4 . **No** REPAIR the circuit. TEST the system for normal operation.
D4 CHECK CIRCUIT 7S-TA33 (YE/VT) FOR OPEN	
• Measure the resistance between brake shift interlock C322 pin 2, circuit 7S-TA33 (YE/VT), harness side and FEM C201f pin 15, circuit 7S-TA33 (YE/VT), harness side.  A0005950 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new FEM; REFER to Section 419-10 . **No** REPAIR the circuit. TEST the system for normal operation.
D5 CHECK CIRCUIT 31-TA33 (BK) FOR AN OPEN	

• Measure the resistance between brake shift interlock C322 pin 1, circuit 31-TA33 (BK), harness side and ground.  A0005951 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new brake shift interlock actuator; REFER to Brake Shift Interlock Actuator . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

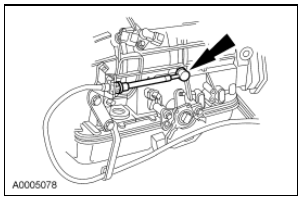
Selector Lever Cable Adjustment

Shift Cable

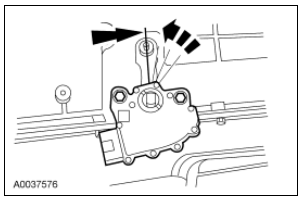
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Place the selector lever in the D5 position.

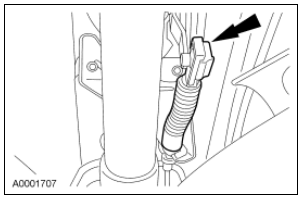
3. Disconnect the transmission shift cable from the manual control lever.



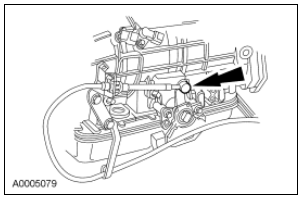
4. Place the manual control lever in the D5 position. This is 3 positions from the most rearward position.



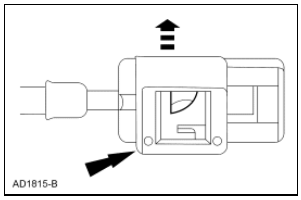
5. Disconnect the transmission shift cable from the selector lever.



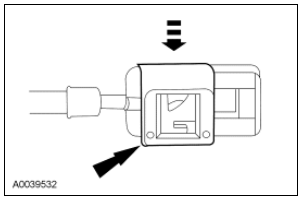
6. Connect the transmission shift cable to the manual control lever.



7. Unlock the adjuster at the end of the cable.



8. Connect the shift cable to the shifter and lock the end of the adjuster.



9. Carefully move the manual control lever from detent-to-detent and compare with transmission settings. Verify that the vehicle will start in PARK or NEUTRAL, and the backup lamps illuminate in REVERSE. If not, steps may need to be repeated and include digital transmission range (TR) sensor adjustment in NEUTRAL. For additional information on transmission range (TR) sensor adjustment, refer to Section 307-01 .
    - Adjust as necessary.

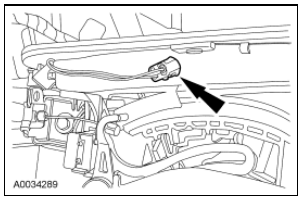
Brake Shift Interlock Actuator

Removal and Installation

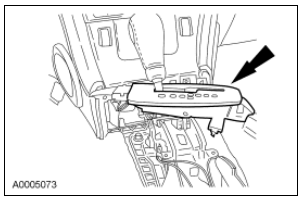
1. **NOTE:** If equipped with traction control, the switch will need to be disconnected prior to removing the center console.

   Remove the center console. For additional information, refer to Section 501-12 .

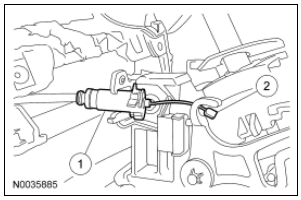
2. Remove the PRNDL indicator bulb from the electrical connector.



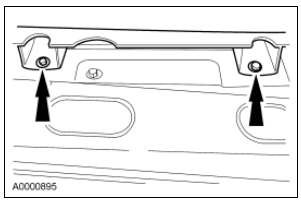
3. Rotate the selector lever bezel.



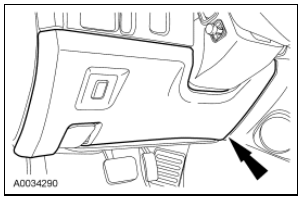
4. Disconnect the cable from the lever.
   1. Remove the shift interlock cable from the bracket.
   2. Disconnect the cable from the lever.



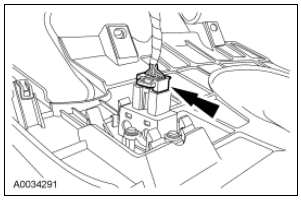
5. Remove the lower steering column cover push pins.



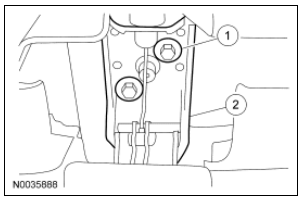
6. Remove the instrument panel steering column cover.



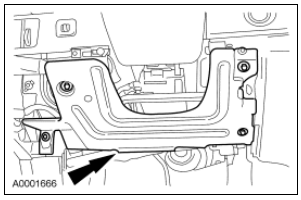
7. Disconnect the electrical connector.



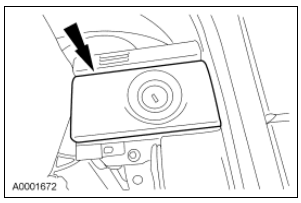
8. Remove the hood release cable and bracket.
    1. Remove the screws.
    2. Position the hood release cable and bracket aside.



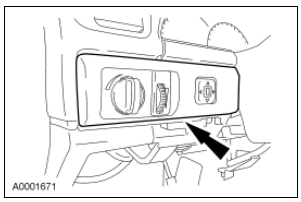
9. Remove the lower reinforcement panel.



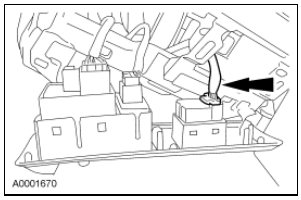
10. Remove the inner instrument panel finish panel.



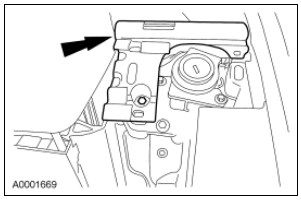
11. Remove the outer instrument panel finish panel.



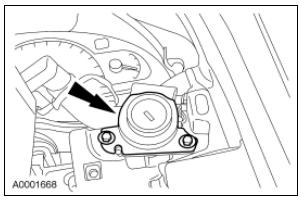
12. Disconnect the power mirror switch.



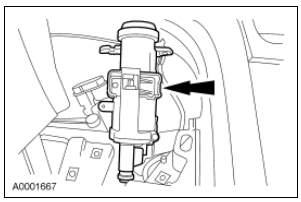
13. Remove the inner trim support panel.



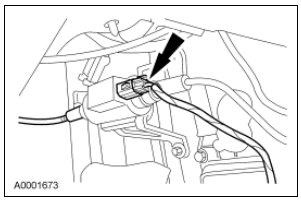
14. Remove the ignition switch.
    - Remove the screws.
    - Remove the ignition switch.



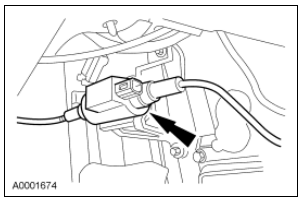
15. Remove 2 screws for the shift lock actuator cable.
    - To install, tighten to 9 Nm (80 lb-in).



16. Disconnect the electrical connector from the brake shift interlock actuator cable.

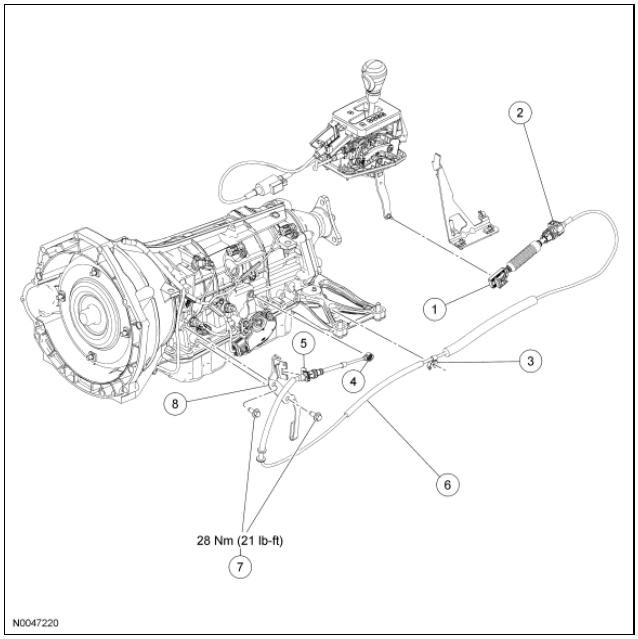


17. Remove the cable from the bracket and remove the cable.



18. To install, reverse the removal procedure.

Selector Lever Cable

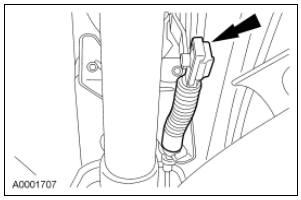


Item	Part Number	Description
1	7E395	Transmission selector lever cable eyelet
2	7E395	Transmission selector lever cable retainer
3	7E395	Transmission selector lever cable retainer
4	7E395	Transmission selector lever cable eyelet
5	7E395	Transmission selector lever cable retainer
6	7E395	Transmission selector lever cable
7	N605918	Transmission selector lever cable bracket screws
8	7B229	Transmission selector lever cable bracket

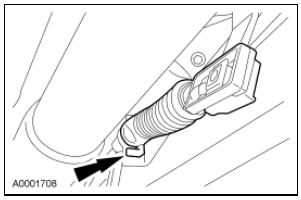
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Place the range selector lever in the D5 position.

3. Disconnect the transmission shift cable eyelet from the selector lever assembly.



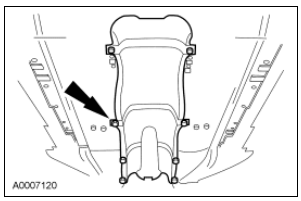
4. Disconnect the shift cable from the bracket.



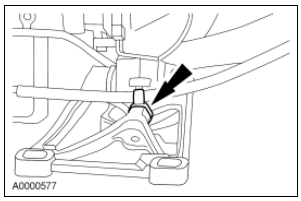
5. **NOTE:** It is not necessary to remove the exhaust.

   Remove the screws that retain the heat shield and lower the heat shield onto the exhaust.

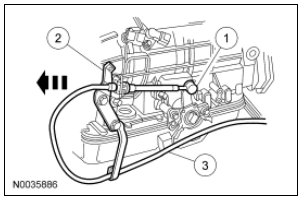
   - To install, tighten to 10 Nm (89 lb-in).



6. Disconnect the transmission selector lever cable retainer.



7. Remove the transmission selector lever cable.
   1. Disconnect the transmission selector lever cable eyelet from the manual control lever.
   2. Depress the tab and slide the transmission selector lever cable out of the selector lever cable bracket.
   3. Remove the transmission selector lever cable.

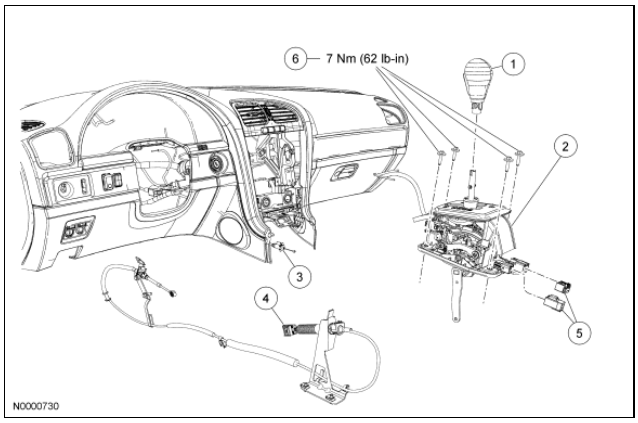


8. To install, reverse the removal procedure.

9. After installing the selector lever cable, it will be necessary to adjust the selector lever cable. For additional information, refer to Selector Lever Cable Adjustment in this section.

Transmission Selector Lever

Removal and Installation



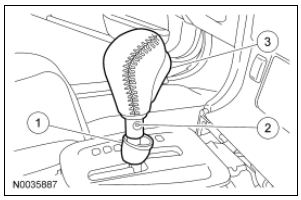
Item	Part Number	Description
1	7L010	Transmission selector lever handle
2	7E034	Transmission selector lever bezel
3	3F719	Transmission brake shift interlock actuator
4	7E395	Transmission selector lever cable
5	15A808	Transmission selector lever electrical connectors
6	7C453	Transmission selector lever assembly bolts

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

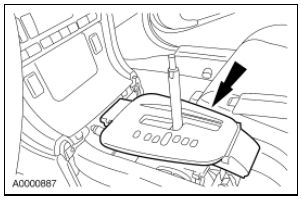
2. Place the range selector lever in the D5 position.

3. Remove the center console. For additional information, refer to Section 501-12 .

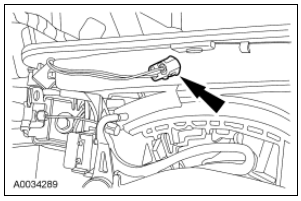
4. Remove the handle and cover.
    1. Slide the cover down.
    2. Remove the 2 screws.
    3. Remove the handle and the cover.



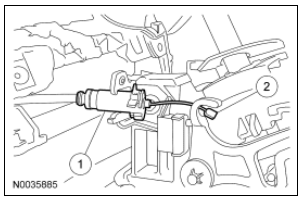
5. Move the shifter bezel aside.



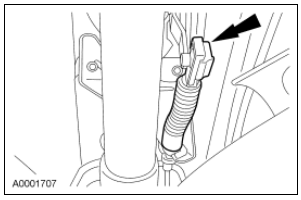
6. Remove the PRNDL indicator bulb from the electrical connector.



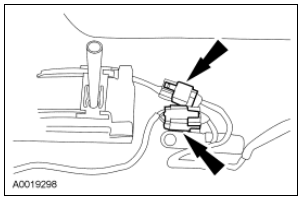
7. Disconnect the cable from the lever.
    1. Remove the shift interlock cable from the bracket.
    2. Disconnect the cable from the lever.



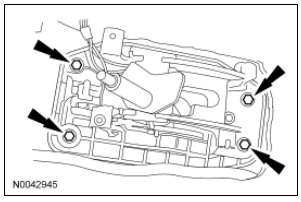
8. Disconnect the transmission shift cable from the shifter assembly.



9. Disconnect the 2 electrical connectors from the shifter assembly.



10. Remove the 4 screws from the shift lever assembly base.
    - To install, tighten to 7 Nm (62 lb-in).



11. **NOTE:** A selector lever cable adjustment must be carried out after installation. For additional information, refer to Selector Lever Cable Adjustment in this section.

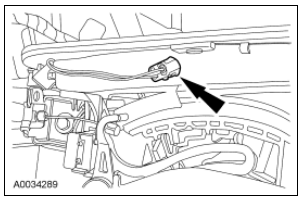
To install, reverse the removal procedure.

Transmission Control (TC) Switch

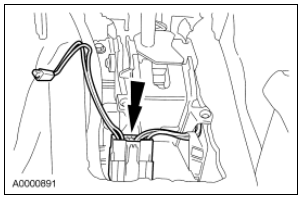
Removal and Installation

1. Remove the center console. For additional information, refer to Section 501-12 .

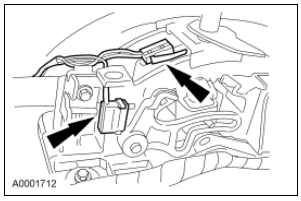
2. Remove the PRNDL indicator bulb from the electrical connector.



3. Disconnect the electrical connector.



4. Disconnect the switches and remove the harness.



5. To install, reverse the removal procedure.

General Specifications

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4â— A
Penetrating Lock and Lubricant XL-1 (Canada CXC-51-A)	—

Torque Specifications

Description	Nm	lb-ft	lb-in
3-way catalytic converter-to-exhaust manifold nuts (3.9L)	40	30	—
Muffler and resonator assembly nuts	47	35	—
Heat shield bolts and nuts	10	—	89
Worm clamp	7	—	62
Exhaust hanger bracket bolts	30	22	—
Heated oxygen sensor	41	30	—
Catalyst monitor sensor	41	30	—

Exhaust System

⚠ WARNING: The normal operating temperature of the exhaust system is very high. Never attempt to repair any part of the system until it has cooled. Be especially careful when working around the 3-way catalytic converter. The temperature of the 3-way catalytic converter rises to a high level after only a few minutes of engine operation. Failure to follow these instructions may result in personal injury.

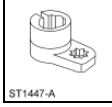
⚠ CAUTION: When repairing the exhaust system or removing exhaust components, disconnect all heated oxygen sensors (HO2S) at the wiring connectors to prevent damage to the HO2S and wiring harness. For additional information, refer to Section 303-14 for the location of the HO2S.

The exhaust system:

- contains dual 3-way catalytic converters.
- has a crossover pipe downstream of the 3-way catalytic converters.
- has 2 upstream HO2S mounted before the 3-way catalytic converters.
- has a production muffler and tailpipe assembly which is a one-piece design.

Exhaust System

Special Tool(s)

ST1493-A	Exhaust Back Pressure Gauge 309-D002 (D95L-6000-A) or equivalent
 ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

Inspection and Verification

1. Verify the concern by running the engine (with the vehicle on the ground) or road testing the vehicle to duplicate the condition.

2. Visually inspect the components of the exhaust system and related controls that may affect exhaust gas quality or loss of power.

3. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets • Damaged catalytic converter • Cracked exhaust manifold • Dirty engine air cleaner • Loose or damaged heat shields

4. Verify that the exhaust system is installed correctly, with clamps correctly located and tightened to specification.

5. If the fault is not visually evident, determine the symptom. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Exhaust System Alignment

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Loosen all fasteners joining the exhaust system components.

3. Beginning at the front of the vehicle, align the exhaust system to establish the maximum clearance. Make sure all fit pipes are pushed all the way into the preceding pipe and the notches are correctly lined up with the tabs.

4. Beginning at the front of the vehicle, tighten all fasteners and clamps to specification. For additional information, refer to Specifications in this section.

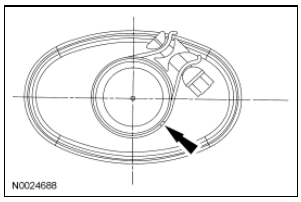
5. Start the engine and check the exhaust system for leaks.

Torca® Clamp

1. Remove the nut from the Torca® clamp.

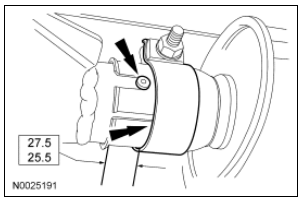
2. Grind the spot weld and the tac weld from the Torca® clamp and remove the clamp.

3. Clean the uneven surface area and position a new Torca® clamp.



4. **NOTE:** Make sure the clamp position is no more than 27.5 mm (1.08 in) or less than 25.5 mm (1 in) from the inlet of the resonator pipe.

   Make sure the back of the slot is covered by the clamp and the button is fully seated inside the notch.

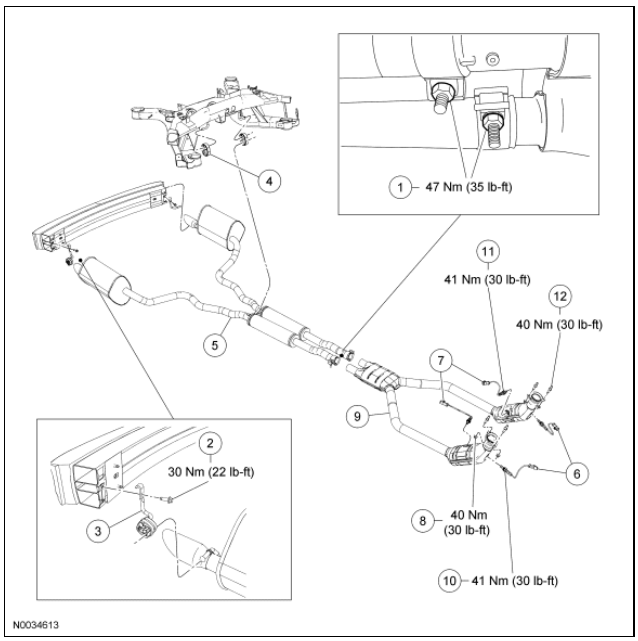


5. **NOTE:** Do not tighten the clamp until the exhaust system has been aligned.

   Tighten the new Torca® clamp.

   - Tighten to 47 Nm (35 lb-ft).

Exhaust System — Exploded View



Item	Part Number	Description
1	—	Torca® clamp (2 required)
2	W500234-S426	Exhaust hanger bracket bolt
3	—	Exhaust hanger bracket
4	5F262	Exhaust hanger insulator
5	5230	Muffler and tailpipe assembly
6	14A464	Catalyst monitor sensor electrical connector (2 required)
7	14A464	Heated oxygen sensor (HO2S) electrical connector (2 required)
8	W705443-S900	Manifold-to-exhaust Y-pipe-dual catalytic converter flange stud nut (4 required)
9	5F250	Exhaust Y-pipe-dual catalytic converter
10	9F472	Catalyst monitor sensor (2 required)
11	9F472	HO2S (2 required)
12	W705717-S900	Manifold-to-exhaust Y-pipe-dual catalytic converter flange stud (4 required)

1. For additional information, refer to the procedures in this section.

Exhaust Y-Pipe — Dual Catalytic Converter

Special Tool(s)

ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A

Removal and Installation

⚠ **WARNING: The normal operating temperature of the exhaust system is very high. Never attempt to repair or install any new part of the system until it has cooled. Be especially careful when working around the 3-way catalytic converter. The temperature of the 3-way catalytic converter rises to a high level after only a few minutes of engine operation.**

NOTE: Exhaust fasteners are of a torque prevailing design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. ⚠ **CAUTION: Use caution removing the catalytic converter. Make sure not to damage the manifold outlet flare, the converter inlet flare or the studs.**

   Support the exhaust Y-pipe-dual catalytic converter near the rear outlet.

3. Disconnect the 2 Torca® clamps. For additional information, refer to Torca® Clamp in this section.
   - To install, tighten to 47 Nm (35 lb-ft).

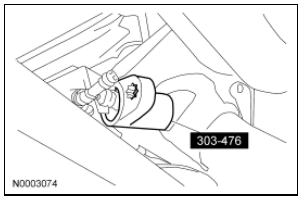
4. Disconnect the 2 heated oxygen sensor (HO2S) electrical connectors.

5. Disconnect the 2 catalyst monitor sensor (CMS) electrical connectors.

6. Remove the 4 manifold-to-exhaust Y-pipe-dual catalytic converter flange stud nuts and the converter assembly.
   - To install, tighten to 40 Nm (30 lb-ft).

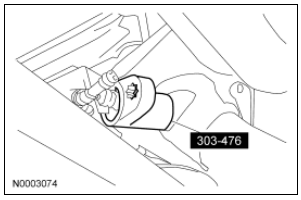
7. If necessary, using the special tool, remove the 2 CMS.
   - **NOTE:** Apply anti-seize to the sensor threads before installation.

     To install, tighten to 41 Nm (30 lb-ft).



8. If necessary, using the special tool, remove the 2 HO2S.
   - **NOTE:** Apply anti-seize to the sensor threads before installation.

   To install, tighten to 41 Nm (30 lb-ft).



9. If necessary, remove the manifold-to-exhaust Y-pipe-dual catalytic converter flange studs.
   - To install, tighten to 40 Nm (30 lb-ft).

10. To install, reverse the removal procedure.

11. **NOTE:** Clean the mating surfaces of the manifold outlet flare and the catalytic converter inlet flare. Support the catalytic converter near the rear outlet. Make sure not to damage the manifold outlet flare, the converter inlet flare or the studs. To correctly seat the converter, alternately tighten the exhaust manifold-to-exhaust Y-pipe-dual catalytic converter nuts to specification.

    Check and, if necessary, align the exhaust system. For additional information, refer to Exhaust System Alignment .

Muffler and Tailpipe

Removal and Installation

⚠ WARNING: The normal operating temperature of the exhaust system is very high. Never attempt to repair or install any new part of the system until it has cooled. Be especially careful when working around the 3-way catalytic converter. The temperature of the 3-way catalytic converter rises to a high level after only a few minutes of engine operation.

⚠ CAUTION: Do not use oil-based or grease-based lubricants on the isolators. They may cause deterioration of the rubber.

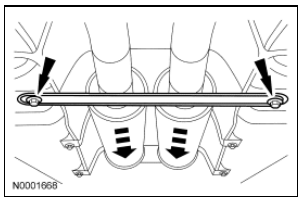
⚠ CAUTION: Oil-based or greased-based lubricants on the isolators may cause the exhaust hanger isolator to separate from the exhaust hanger bracket during vehicle operation.

NOTE: Exhaust fasteners are of a torque prevailing design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Using a suitable jackstand, support the muffler and tailpipe assembly.

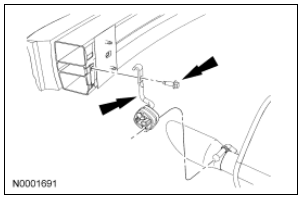
3. Remove the 2 bolts and the brace.
   - To install, tighten to 25 Nm (18 lb-ft).



4. **NOTE:** The insulators should not be reused. If the exhaust system is removed from the vehicle, install new insulators.

   Remove the 2 exhaust hanger bracket bolts and the exhaust hanger brackets as an assembly.

   - To install, tighten to 30 Nm (22 lb-ft).



5. Remove the 2 exhaust hanger insulators.

6. Disconnect the 2 Torca® clamps and remove the muffler and tailpipe assembly. For additional information, refer to Torca® Clamp in this section.

- To install, tighten to 47 Nm (35 lb-ft).

7. To install, reverse the removal procedure.

8. Check and, if necessary, align the exhaust system. For additional information, refer to Exhaust System Alignment .

General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A
Fuel Tank Capacity	
Capacity	68 liters (18 gallons)
Fuel Pressure	
Key on, engine off	207-380 kPa (30-55 psi)
Engine running	207-380 kPa (30-55 psi)

Fuel System

The vehicle:

- is equipped with a multiport fuel injection (MFI) system.
- uses separately controlled fuel injectors mounted to the intake manifold for each cylinder.
- has fuel injectors that are supplied with pressurized fuel from the fuel delivery module through the jet pump transfer module, through the fuel injection supply manifold.
- has a fuel injection supply manifold that is controlled by the electronic fuel delivery module which is enabled by the powertrain control module (PCM).
- uses an electronic returnless fuel system.
- has a dual-container (saddle type) fuel tank, each half equipped with a fuel level sensor.
- has a fuel transfer pump in the left fuel tank half to supply fuel to the right, which contains the fuel pump module that supplies fuel under pressure to the fuel injection supply manifold.
- has an inertia fuel shutoff (IFS) switch, located behind the driver side left foot kick panel, which shuts off the fuel in the event of collision.
- has a fuel system filter, located behind the left front wheel well splash shield.

Fuel System

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: The following procedure diagnoses a slow to fill concern only. For all other concerns refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

The fuel tank filler pipe assembly is used to refuel the vehicle. The fuel tank inlet check valve prevents spitback of fuel during and after refueling. The fuel tank stores the fuel. The fuel tank contains a Fuel Pump (FP) module. The FP module consists of a fuel level sensor and a FP . The fuel level sender sends a signal to the fuel gauge informing the driver of how much fuel is in the fuel tank. The FP provides fuel to the fuel tubes which supply the fuel rail.

During refueling, the fuel tank vents to the atmosphere through the vent and filler pipes, on vehicles without On-Board Refueling Vapor Recovery (ORVR) systems. In vehicles equipped with ORVR , the fuel tank and filler pipe are designed so that when the vehicle is being refueled, fuel vapors in the fuel tank travel to the Evaporative Emission (EVAP) canister, which absorbs the fuel vapors and vents the pressure from the fuel tank during refueling.

Inspection and Verification

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Verify the customer's concern by refueling the vehicle and observe the fuel fill rate.

2. Inspect to determine if any of the following mechanical concerns apply.

Visual Inspection Chart

Mechanical

- Bent, kinked or damaged fuel tank filler pipe
- Bent, kinked or damaged fuel tank filler pipe vent tube (if equipped)
- Incorrect routing of the fuel tank filler pipe
- Incorrect routing of the fuel tank filler pipe vent tube (if equipped)
- Incorrect position of fuel tank filler pipe clamps
- Incorrect position of fuel tank filler pipe vent tube clamps (if equipped)
- Fuel tank mounted vapor tubes bent or damaged
- Evaporative Emission (EVAP) system tubes or hoses bent or damaged
- Accident damage to the fuel tank
- Accident damage to the vehicle effecting the fuel tank filler pipe-to-body connection
- Unauthorized modifications and/or alterations to the vehicle
- EVAP system fresh air tube plugged (dirt, spider webbing)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the Evaporative Emission (EVAP) system.

9. If the DTCs retrieved are related to the concern, go to Evaporative Emission (EVAP) System DTC Chart. For PCM related DTCs, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Chart

Evaporative Emission (EVAP) System DTC Chart

DTC	Description	Action
P0446	Evaporative Emission System Vent Control Circuit	GO to Pinpoint Test A .
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	GO to Pinpoint Test A .
P0452	Evaporative Emission System Pressure Sensor/Switch Low	GO to Pinpoint Test A .
P0453	Evaporative Emission System Pressure Sensor/Switch High	GO to Pinpoint Test A .
P0454	Evaporative Emission System Pressure Sensor/Switch Intermittent	GO to Pinpoint Test A .
P1450	Unable to Bleed up Fuel Tank Vacuum	GO to Pinpoint Test A .
P1451	Evaporative Emission System Vent Control Circuit	GO to Pinpoint Test A .
P260F	Emission System Monitoring Processor Performance	GO to Pinpoint Test A .

Symptom Chart

Symptom Chart

Pinpoint Test

Pinpoint Test A: Slow to Fill

Normal Operation

Under normal operation, fuel should flow at a steady rate through the fuel tank filler pipe into the fuel tank. As fuel enters the fuel tank, air is vented through the filler pipe or the On-Board Refueling Vapor Recovery (ORVR) system.

This pinpoint test is intended to diagnose the following:

- Fuel tank filler pipe vent tube, if equipped
- Fuel tank filler pipe
- Evaporative Emission (EVAP) system
- Fuel tank inlet check valve (part of the fuel tank)
- Fuel level vent valve (part of the fuel tank)

PINPOINT TEST A: SLOW TO FILL

Test Step	Result / Action to Take
A1 CARRY OUT INSPECTION AND VERIFICATION	
• Carry out inspection and verification. • **Was the cause of the concern found?**	**Yes** REPAIR or INSTALL new components to correct the concern. **No** GO to A2 .

A2 CHECK THE SYSTEM FOR ANY EVAP DTCs	
• Connect the scan tool. • Check the system for any of the following EVAP DTCs: P0446, P0451, P0452, P0453, P0454, P1450, P1451 and P260F. • **Are any of these DTCs present?**	**Yes** REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the EVAP system. **No** GO to A3 .
A3 MONITOR THE FUEL TANK PRESSURE (FTP) WHILE FILLING THE FUEL TANK	
• Monitor the FTP reference value while filling the fuel tank. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is FTP within specification?**	**Yes** GO to A5 . **No** GO to A4 .
A4 MONITOR THE FTP WHILE FILLING THE FUEL TANK WITH THE EVAP SYSTEM DISCONNECTED	
• Disconnect the fuel tank-to- EVAP canister quick connect coupling at the EVAP canister. Refer to Quick Connect Coupling in this section. • Monitor the FTP reference value while filling the fuel tank. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is FTP within specification?**	**Yes** INSPECT the EVAP system for blockage or restrictions. REPAIR the blockage or restriction. If the restriction or blockage cannot be repaired, INSTALL new EVAP system components. **No** GO to A5 .
A5 CHECK THE FUEL TANK FILLER PIPE ASSEMBLY FOR BLOCKAGE OR RESTRICTION	
• Remove the fuel tank filler pipe assembly. Refer to Section 310-01 . • Inspect the fuel tank filler pipe and fuel tank filler pipe vent tube (if equipped) for a blockage or restriction. • **Is the fuel tank filler pipe or fuel tank filler pipe vent tube (if equipped) blocked or restricted?**	**Yes** If possible, REPAIR the blockage or restriction. If the blockage or restriction cannot be repaired, INSTALL a new fuel tank filler pipe or fuel tank filler pipe vent tube. **No** GO to A6 .
A6 CHECK THE FUEL TANK INLET CHECK VALVE	
• Inspect the fuel tank inlet check valve for restriction or sticking. • **Is the fuel tank filler pipe inlet check valve restricted or sticking?**	**Yes** If possible, REPAIR the restriction. If the restriction cannot be repaired, INSTALL a new fuel tank. REFER to Section 310-01 . **No** INSTALL a new fuel tank. REFER to Section 310-01 .

Fuel System Pressure Release

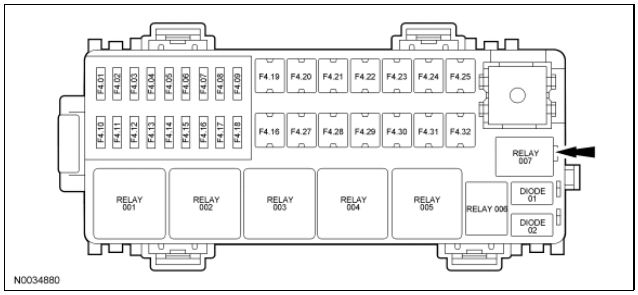
⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

⚠ WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to follow these instructions can result in personal injuries.

1. **NOTE:** The fuel pump relay is located in the main power distribution box, relay number 007.

   Remove the fuel pump relay.



2. Start the engine and allow it to idle until it stalls.

3. After the engine stalls, crank the engine for approximately 5 seconds to make sure the fuel injection supply manifold pressure has been released.

4. Turn the ignition switch to the OFF position.

5. When fuel system service is complete, install the fuel pump relay.

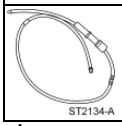
6. **NOTE:** It may take more than one key cycle to pressurize the fuel system.

   Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

7. Start the vehicle and check the fuel system for leaks.

Fuel Tank Draining

Special Tool(s)

ST1134A	Fuel Storage Tanker 164-R3202 or equivalent
ST2803-A	Fuel Sender Wrench 310-123
 ST2134-A	Fuel Drain Hose 310-102

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions can result in personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions can result in personal injury.

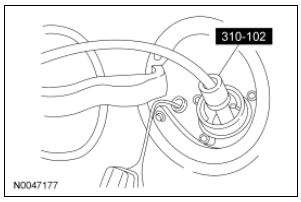
⚠ WARNING: This procedure involves fuel handling. Be prepared for spillage at all times and always observe fuel handling precautions. Failure to follow these instructions can result in personal injury.

1. Release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01

3. **NOTE:** This step will only drain 1/8 of the fuel when tank is full. The fuel pump and transfer pump are below the fuel level when the fuel tank is full. This will prevent fuel spillage when the pumps are removed from the fuel tank.

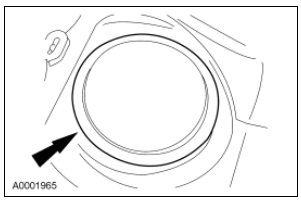
   Insert the special tool into the fuel tank filler pipe until it reaches the fuel tank spout.



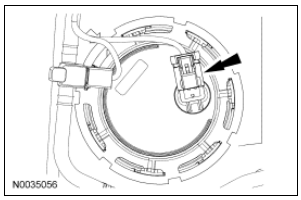
4. Attach the Fuel Storage Tanker to the Fuel Drain Hose and remove any residual fuel in the fuel tank filler pipe.

5. Remove the rear seat bottom and any insulation padding covering the fuel module and the transfer pump access covers. For additional information, refer to Section 501-10 .

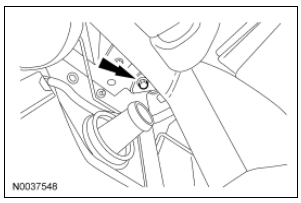
6. Remove the fuel pump module and fuel transfer pump access covers.



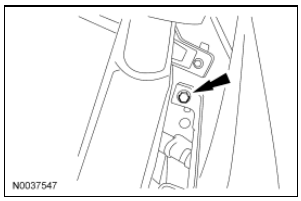
7. Disconnect the electrical connector from the fuel transfer pump.



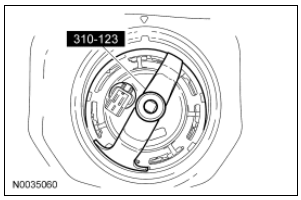
8. Loosen the right fuel tank support strap approximately one inch.
   - To install, tighten to 35 Nm (26 lb-ft).



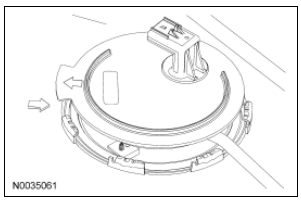
9. Loosen the left fuel tank support strap approximately one inch.
   - To install, tighten to 35 Nm (26 lb-ft).



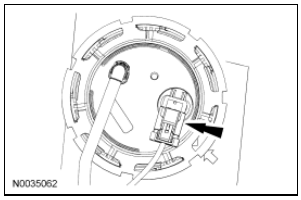
10. Using the special tool, remove the fuel transfer pump lock ring.



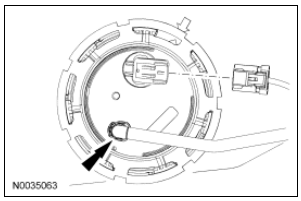
11. Carefully position the fuel transfer pump aside and using the Fuel Drain Hose and the Fuel Storage Tanker, drain the fuel from the RH side of the fuel tank.



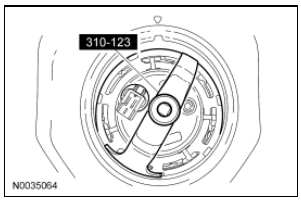
12. Disconnect the electrical connector on the fuel pump module.



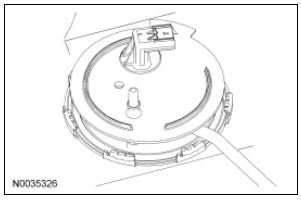
13. Disconnect the fuel tube quick connect coupling on the fuel pump module. For additional information, refer to Quick Connect Coupling in this section.



14. Using the special tool, remove the fuel pump module lock ring.



15. Carefully position the fuel pump module aside and using the Fuel Drain Hose and the Fuel Storage Tanker, drain the fuel from the LH side of the fuel tank.



Quick Connect Coupling

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

Disconnect — Type 1

⚠ WARNING: Do not carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable vapors are always present and can ignite. Failure to follow these instructions may result in personal injury.

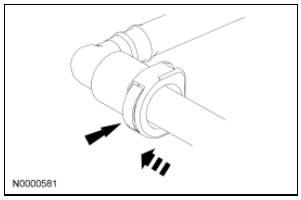
⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to use these instructions can result in personal injury.

⚠ CAUTION: If the liquid or vapor tube is damaged (torn, holes or delaminated), the affected tube assembly must be replaced with a new tube assembly. Do not use aftermarket sleeving. Do not re-adhere loose sleeving material.

⚠ CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the quick connect coupling.

⚠ CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

1. If disconnecting a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to Section 310-00 .



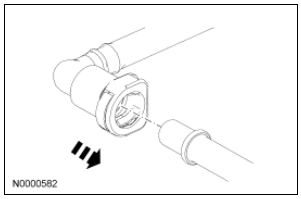
2. Disconnect the quick connect coupling from the tube.
   - Press the quick connect coupling release button and separate the the quick connect coupling from the tube.

Connect — Type I

1. **⚠ CAUTION: Make sure the tube clicks into place when installing into the quick connect coupling. To make sure the tube is fully seated, pull on the quick connect coupling.**

   NOTE: Apply clean engine oil to O-ring seals.

   Install the quick connect coupling onto the tube.



Disconnect — Type II

⚠ WARNING: Do not carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable vapors are always present and can ignite. Failure to follow these instructions may result in personal injury.

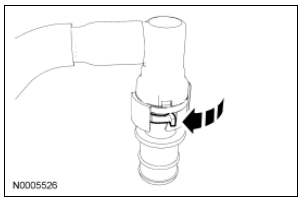
⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to use these instructions can result in personal injury.

⚠ CAUTION: If the liquid or vapor tube is damaged (torn, holes or delaminated), the affected tube assembly must be replaced with a new tube assembly. Do not use aftermarket sleeving. Do not re-adhere loose sleeving material.

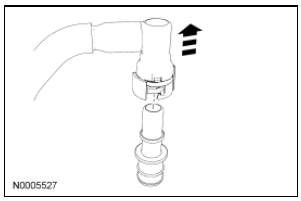
⚠ CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the quick connect coupling.

⚠ CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

1. Release the lock tab on the quick connect coupling.

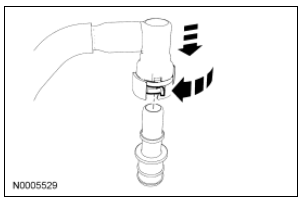


2. Separate the quick connect coupling from the tube.



Connect — Type II

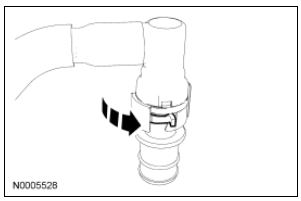
1. Release the lock tab and install the quick connect coupling onto the tube.



2. **⚠ CAUTION: Make sure the fuel tube clicks into place when installing the quick connect coupling. To make sure the tube is fully seated, pull on the quick connect coupling.**

   NOTE: Apply clean engine oil to O-ring seals.

   Apply lock tab into the LATCHED position.



Disconnect — Type III

⚠ WARNING: Do not carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable vapors are always present and can ignite. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to use these instructions can result in personal injury.

⚠ CAUTION: If the liquid or vapor tube is damaged (torn, holes or delaminated), the affected tube assembly must be replaced with a new tube assembly. Do not use aftermarket sleeving. Do not re-adhere loose sleeving material.

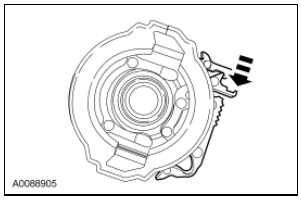
⚠ CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

⚠ CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the quick connect coupling.

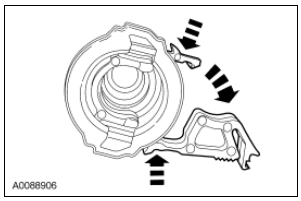
1. If disconnecting a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to Section 310-00 .

2. **NOTE:** Carefully release the lock tab to avoid breakage.

   Release the quick connect coupling primary lock tab.



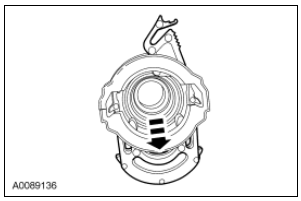
3. Rotate the primary lock tab to the fully OPEN position and squeeze the secondary lock tabs to release the locking mechanism.



4. ⚠ **CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the quick connect coupling.**

   Disconnect the quick connect coupling from the tube.

   - Push the locking mechanism outward and separate the quick- connect coupling from the tube.

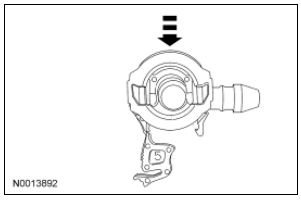


Connect — Type III

1. ⚠ **CAUTION: Make sure the retainer clip clicks into place when installing.**

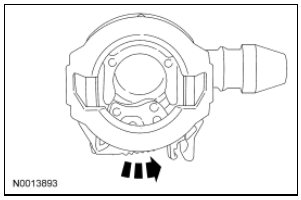
   NOTE: Apply clean engine oil to O-ring seals.

   Depress the retainer clip until it is flush with the quick connect coupling housing and it is fully seated on the tube.



2. ⚠ **CAUTION: To make sure the tube is fully seated, pull on the quick connect coupling.**

   Rotate the primary locking tab to the CLOSED position.



Disconnect — Type IV

⚠ WARNING: Do not carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable vapors are always present and can ignite. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to use these instructions can result in personal injury.

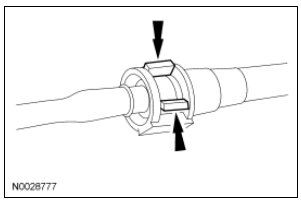
⚠ CAUTION: If the liquid or vapor tube is damaged (torn, holes or delaminated), the affected tube assembly must be replaced with a new tube assembly. Do not use aftermarket sleeving. Do not re-adhere loose sleeving material.

⚠ CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

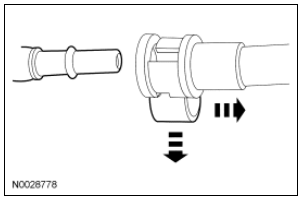
⚠ CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the quick connect coupling.

1. If disconnecting a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to Section 310-00 .

2. Squeeze the quick connect coupling retainer clip tabs to release the locking mechanism.



3. Disconnect the quick connect coupling from the tube.
   - Push the locking mechanism outward to release the quick connect coupling.
   - Pull on the quick connect coupling and separate it from the tube.



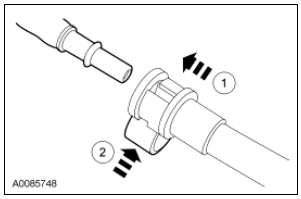
Connect — Type IV

1. **⚠ CAUTION: Make sure the tube clicks into place when installing into the quick connect coupling. To make sure the tube is fully seated, pull on the quick connect coupling.**

NOTE: Apply clean engine oil to O-ring seals.

Connect the quick connect coupling to the tube.

1. Install the quick connect coupling onto the tube until it is fully seated.
2. Depress the locking tab until it is flush with the quick connect coupling housing.



Disconnect — Type V

⚠ WARNING: Do not carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable vapors are always present and can ignite. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to use these instructions can result in personal injury.

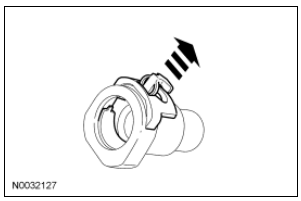
⚠ CAUTION: If the liquid or vapor tube is damaged (torn, holes or delaminated), the affected tube assembly must be replaced with a new tube assembly. Do not use aftermarket sleeving. Do not re-adhere loose sleeving material.

⚠ CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or tubes.

⚠ CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube. Apply clean engine oil to the end of the tube before inserting the tube into the quick connect coupling.

1. If disconnecting a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to Section 310-00 .

2. Release the lock tab on the quick connect coupling.



3. Disconnect the quick connect coupling from the tube.
   - Pull on the quick connect coupling and separate it from the tube.

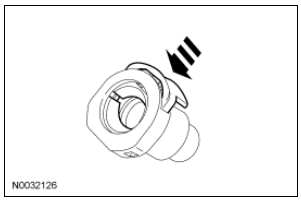
Connect — Type V

1. **NOTE:** Apply clean engine oil to the O-ring seals.

   Install the quick connect coupling onto the tube until fully seated.

2. ⚠ **CAUTION: Make sure the quick connect coupling clicks into place when installing the tube. To make sure the tube is fully seated, pull on the quick connect coupling.**

   Depress the retainer clip until it is flush with the quick connect coupling housing.



Spring Lock Couplings

Special Tool(s)

ST1146-A	Disconnect Tool, Spring Lock Coupling (3/8 Inch, Yellow) 310-D004 (D87L-9280-A) or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Disconnect

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

NOTICE: **When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retainer clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.**

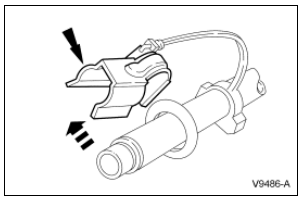
NOTICE: **Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component**

damage can occur. Always install blanking plugs to any open orifices or tubes.

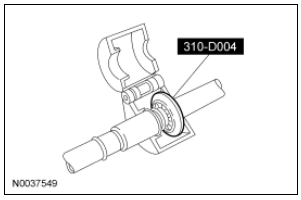
1. If disconnecting a liquid fuel tube spring lock coupling, release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

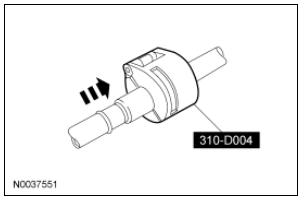
3. Remove the fuel tube safety clip.



4. Install the Spring Lock Coupling Disconnect Tool onto the spring lock coupling.



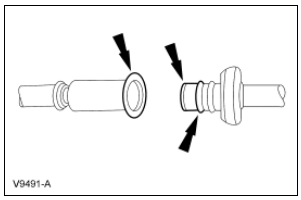
5. Close and push the Spring Lock Coupling Disconnect Tool into the open side of the cage.



6. Disconnect the spring lock coupling from the tube fitting.

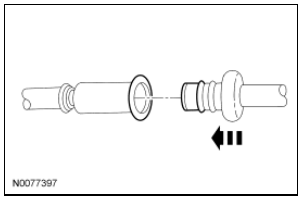
Connect

1. Inspect and clean the tube fitting, spring lock coupling and the O-ring seals.
   - Lubricate the O-ring seals with clean engine oil.

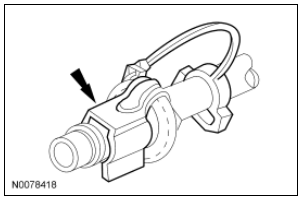


2. **NOTE:** Make sure the spring lock coupling is completely seated and locked in place by pulling on the coupling.

   Connect the spring lock coupling onto the tube fitting.



3. Install the safety clip.



4. Connect the battery ground cable. For additional information, refer to Section 414-01 .

General Specifications

Item	Specification
Lubricants and Sealants	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Fuel tube shield bolt	5	—	44
Fuel tank strap bolts	35	26	—
Fuel filler pipe mounting bolt	9	—	80
Fuel hose mounting bolt	9	—	80
Fuel filter bracket bolt	7	—	62
Fuel tube shield nuts	5	—	44
Fuel tube shield bolts	5	—	44
Fuel tube mounting bolts	7	—	62
Fuel tank filler hose clamps	3	—	27
Fuel tank filler pipe mounting screws	2	—	18

Fuel Tank and Lines

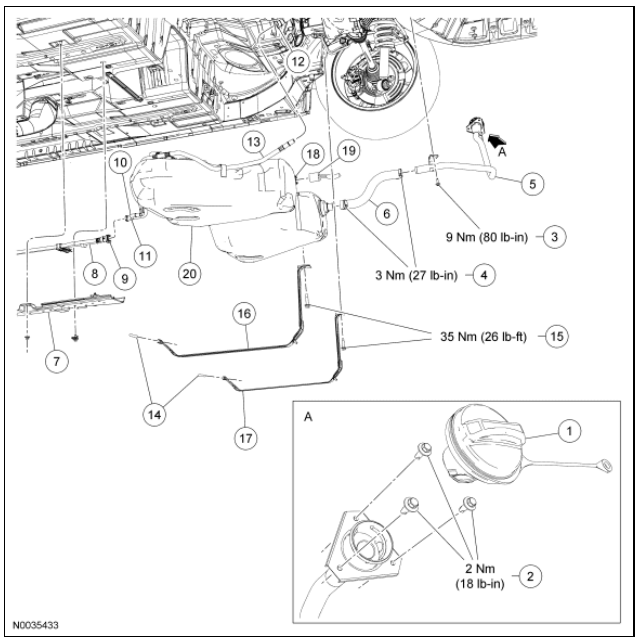
The vehicle:

- is equipped with a multiport fuel injection (MFI) system.
- uses separately controlled fuel injectors mounted to the intake manifold for each cylinder.
- has fuel injectors that are supplied with pressurized fuel from the fuel delivery module through the jet pump transfer module, through the fuel injection supply manifold.
- has a fuel injection supply manifold that is controlled by the electronic fuel delivery module which is enabled by the powertrain control module (PCM).
- uses an electronic returnless fuel system.
- has a dual-container (saddle type) fuel tank, each half equipped with a fuel level sensor.
- has a fuel transfer pump in the left fuel tank half to supply fuel to the right, which contains the fuel pump module that supplies fuel under pressure to the fuel injection supply manifold.
- has an inertia fuel shutoff (IFS) switch, located behind the driver side left foot kick panel, which shuts off the fuel in the event of collision.
- has a fuel system filter, located behind the left front wheel well splash shield.

Fuel Tank and Lines

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Fuel Tank and Filler Pipe — Exploded View



Item	Part Number	Description
1	9030	Fuel tank filler cap
2	W701082	Fuel tank filler pipe mounting screws (3 required)
3	W503925	Fuel tank filler pipe mounting bolt
4	W525936	Fuel tank filler pipe hose clamps (2 required)
5	9034	Fuel tank filler pipe
6	9047	Fuel tank filler pipe hose
7	9C291	Fuel tube shield
8	9S284	Fuel tube
9	—	Vapor tube quick connect coupling (part of 9J274)
10	9C047	Fuel vapor control tube assembly valve
11	—	Fuel tube quick connect coupling (part of 9K007)
12	—	Fuel vapor tube quick connect coupling (part of 9E857)
13	9C047	Fuel vapor control tube assembly valve
14	W710790	Fuel tank strap retainer pins (2 required)
15	W506435	Fuel tank strap retainer bolts (2 required)
16	9055	Fuel tank strap
17	9055	Fuel tank strap
18	—	Fuel tank harness electrical connector (part of 14407)
19	14A464	Fuel tank harness electrical connector
20	9K007	Fuel tank

1. For additional information, refer to the procedures in this section.

Fuel Tank

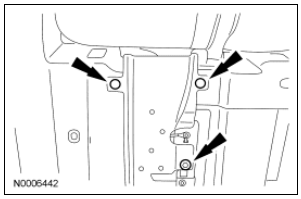
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the fuel tank. For additional information, refer to Section 310-00 .

3. Remove the driveshaft. For additional information, refer to Section 205-01 .

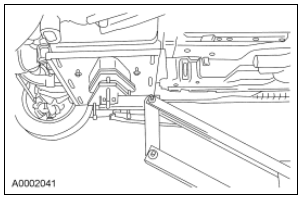
4. Remove the 2 pin-type retainers and the bolt and position aside the fuel tube shield.
   - To install, tighten to 5 Nm (44 lb-in).



5. Disconnect the fuel tube quick connect coupling and the vapor tube quick connect coupling. For additional information, refer to Section 310-00 .

6. Release the clamp and disconnect the fuel tank filler pipe hose from the fuel tank.

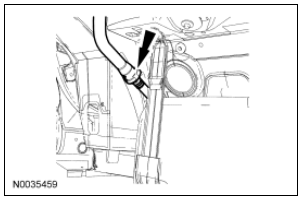
7. Position a suitable lifting device to support the fuel tank.



8. Remove the 2 fuel tank strap mounting bolts and position aside the 2 fuel tank straps.
   - To install, tighten to 35 Nm (26 lb-ft).

9. Disconnect the fuel tank electrical connector.

10. Partially lower the fuel tank and disconnect the vapor tube quick connect coupling. For additional information, refer to Section 310-00 .



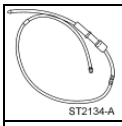
11. Remove the fuel tank.

12. To install, reverse the removal procedure.

- Turn the ignition key to the ON position to pressurize the fuel system.
- Visually inspect the fuel system for leaks.

Fuel Tank Filler Pipe

Special Tool(s)

 ST2134-A	Fuel Drain Hose 310-102
ST1134A	Fuel Storage Tanker 164-R3202 or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W-20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A

Removal and Installation

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions can result in personal injury.

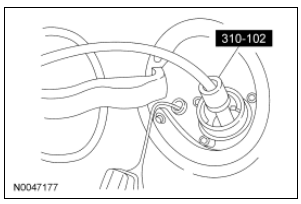
⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to follow these instructions can result in personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the fuel tank filler cap and position it aside.

3. **NOTE:** This step will drain approximately 1/8th of the fuel when the fuel tank is full.

   Insert the special tool into the fuel tank filler pipe unit it reaches the fuel tank spout.



4. Attach the fuel storage tanker to the fuel drain hose and remove any residual fuel in the fuel tank filler pipe.

5. Remove the 3 fuel tank filler pipe mounting screws.
    - To install, tighten to 2 Nm (18 lb-in).

6. Remove the right rear inner fender well splash shield.

7. Remove the fuel tank filler pipe mounting bolt.
    - To install, tighten to 9 Nm (80 lb-in).

8. ⚠ **CAUTION: Some fuel will remain in the fuel tank filler pipe after draining the fuel tank. Carefully drain the fuel tank filler pipe into an approved container.**

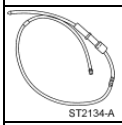
   Disconnect the fuel tank filler pipe from the fuel tank filler pipe hose and remove from the fuel tank.

9. **NOTE:** Lubricate the fuel tank filler pipe end with clean engine oil.

   To install, reverse the removal procedure.

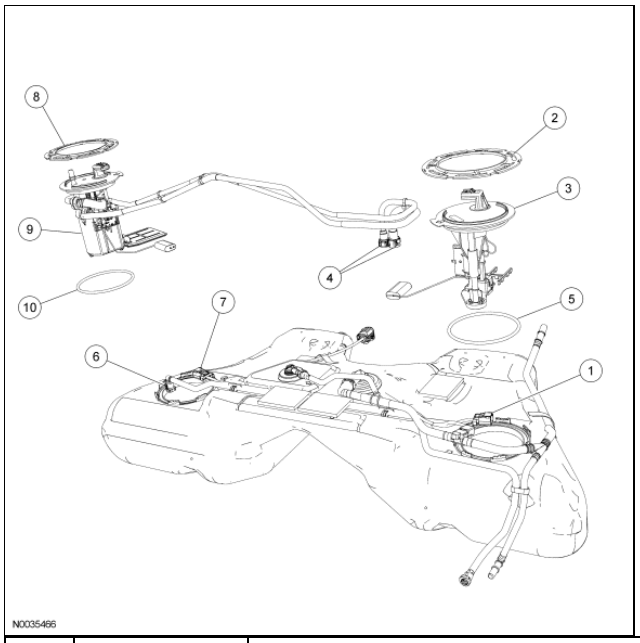
Fuel Pump Module

Special Tool(s)

ST2803-A	Fuel Sender Wrench 310-123
 ST2134-A	Fuel Drain Hose 310-102
ST1134A	Fuel Storage Tanker 164-R3202 or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	14A464	Fuel transfer pump electrical connector (part of 14407)
2	9A307	Fuel transfer pump lock ring
3	9275	Fuel transfer pump

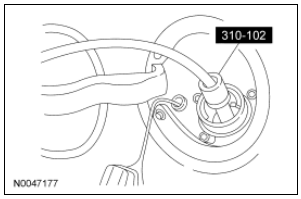
4	—	Fuel crossover tube quick connect couplings (part of 9H307)
5	9276	Fuel transfer pump O-ring seal
6	—	Fuel pump module tube quick connect coupling
7	14A464	Fuel pump module electrical connector (part of 14407)
8	9A307	Fuel pump module lock ring
9	9H307	Fuel pump module
10	9276	Fuel pump module O-ring seal

Removal

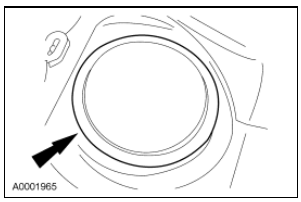
⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions can result in personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to follow these instructions can result in personal injury.

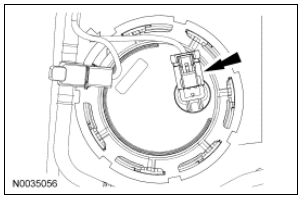
1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Insert the special tool into the fuel tank filler pipe until it reaches the fuel tank spout.



4. Attach the fuel storage tanker to the fuel drain hose and remove any residual fuel in the fuel in the fuel tank filler pipe.
5. Remove the rear seat bottom and any insulation padding covering the fuel pump module and the fuel transfer pump access covers. For additional information, refer to Section 501-10 .
6. Remove the fuel pump module and the fuel transfer pump access covers.



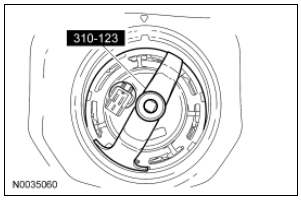
7. Disconnect the electrical connector from the fuel transfer pump module.



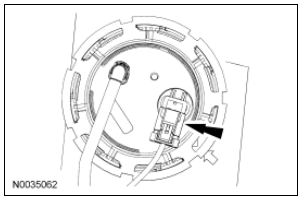
8. Loosen the right fuel tank support strap approximately one inch.

9. Loosen the left fuel tank support strap approximately one inch.

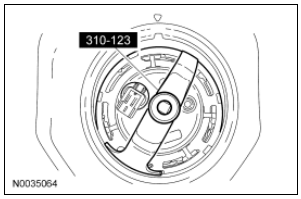
10. Using the special tool, remove the fuel transfer pump lock ring.



11. Disconnect the electrical connector on the fuel pump module.



12. Using the special tool, remove the fuel pump module lock ring.



13. **NOTE:** The routing of the internal fuel crossover tubes is critical to correct fuel system operation. Note the routing of the internal fuel crossover hoses at this time.

    Partially raise the fuel transfer pump and disconnect the internal fuel crossover tube quick connect couplings.

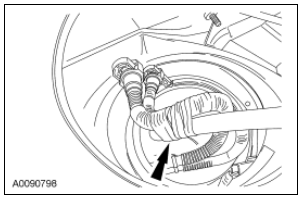
    - Remove and discard the fuel transfer pump O-ring seal.

14. Disconnect the fuel pump module tube quick connect coupling from the fuel pump module and position aside.

15. ⚠ **CAUTION: Drain the remaining fuel from the delivery module into the fuel tank prior to removal.**

    Before removal, attach a non-conductive material to the crossover tubes. Then remove the fuel pump module and crossover tubes as an assembly, using the non-conductive material to pull the crossover lines through the gas tank.

    - Remove and discard the fuel pump module O-ring seal.



Installation

1. **NOTE:** Install the fuel pump module and crossover tubes as an assembly.

   Attaching the non-conductive material to the crossover tubes, pull the crossover tubes through the gas tank to install the fuel pump module.

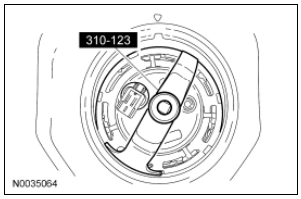
2. ⚠ **CAUTION: Inspect the surfaces of the fuel pump module flange and fuel tank O-ring seal contact surfaces. Do not polish or adjust the O-ring seal contact area of the fuel tank flange or the fuel tank. Install a new fuel pump module or fuel tank if the O-ring seal contact area is bent, scratched or corroded.**

   NOTE: Make sure the alignment arrows on the fuel pump module and the fuel tank meet before tightening the fuel pump module lock ring.

   NOTE: Apply clean engine oil to the O-ring seal.

   Using the special tool, install the fuel pump module and lock ring.

   - Install a new fuel pump module lock ring and O-ring seal.
   - To install, tighten the fuel pump module lock ring until the lock tabs are seated against the stops.



3. **NOTE:** Make sure that the fuel crossover tubes are routed correctly.

   Partially raise the fuel transfer pump and connect the internal fuel crossover hose quick connect couplings.

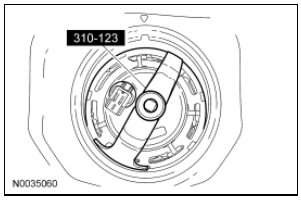
4. ⚠ **CAUTION: Inspect the surfaces of the fuel transfer pump flange and fuel tank O-ring seal contact surfaces. Do not polish or adjust the O-ring seal contact area of the fuel tank flange or the fuel tank. Install a new fuel transfer pump or fuel tank if the O-ring seal contact area is bent, scratched or corroded.**

   NOTE: Make sure the alignment arrows on the fuel transfer pump and the fuel tank meet before tightening the fuel pump module lock ring.

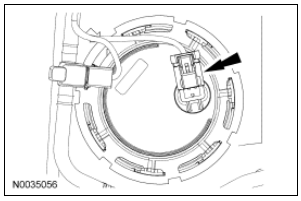
   NOTE: Apply clean engine oil to the O-ring seal.

   Using the special tool, install the fuel transfer pump and lock ring.

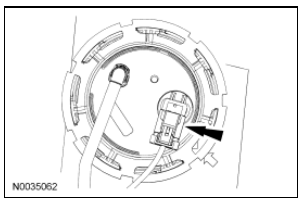
   - Install a new fuel transfer pump lock ring and O-ring seal.
   - To install, tighten the fuel transfer pump lock ring until the lock tabs are seated against the stops.



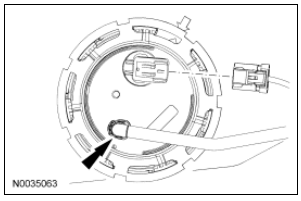
5. Connect the electrical connector on the fuel transfer pump.



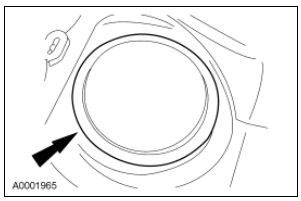
6. Connect the electrical connector on the fuel pump module.



7. Connect the fuel tube quick connect coupling on the fuel pump module.



8. Install the fuel pump module and fuel transfer pump access covers.



9. Install the rear seat bottom and any insulation padding covering the access covers. For additional information, refer to Section 501-10 .

10. Tighten the 2 fuel tank support strap bolts.
    - Tighten to 35 Nm (26 lb-ft).

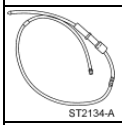
11. Connect the battery ground cable. For additional information, refer to Section 414-01 .

12. Turn the ignition key to the ON position to pressurize the fuel system.

13. Visually inspect the fuel system for leaks.

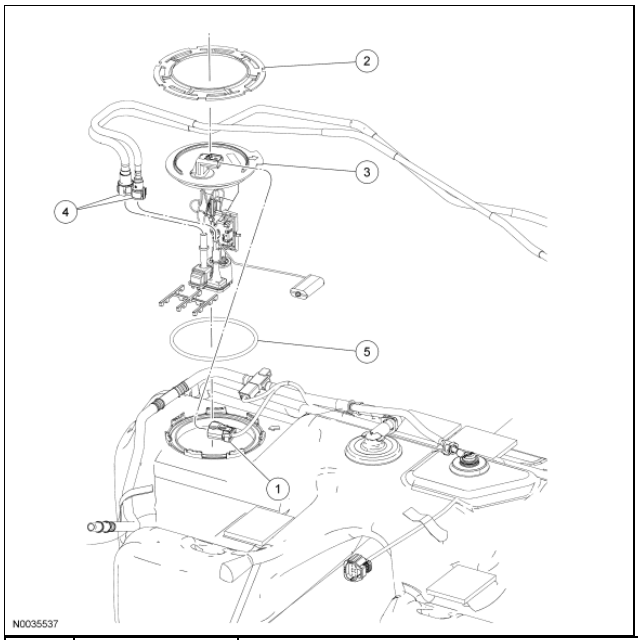
Fuel Transfer Pump

Special Tool(s)

ST2803-A	Fuel Sender Wrench 310-123
 ST2134-A	Fuel Drain Hose 310-102
ST1134A	Fuel Storage Tanker 164-R3202 or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (in Canada Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12) or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	14A464	Fuel transfer pump electrical connector (part of 14407)
2	9C385	Fuel transfer pump lock ring
3	9275	Fuel transfer pump

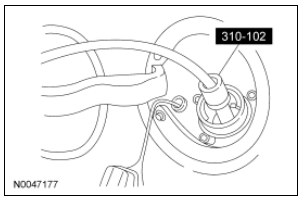
4	—	Fuel crossover tube quick connect couplings (2 required) (part of 9H307)
5	9276	Fuel transfer pump O-ring seal

Removal

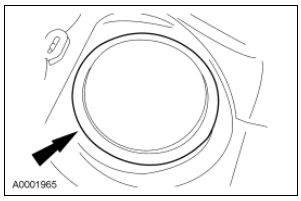
⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions can result in personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related components. Highly flammable mixtures are present and may be ignited. Failure to follow these instructions can result in personal injury.

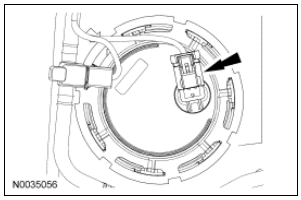
1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Insert the special tool into the fuel tank filler pipe until it reaches the fuel tank spout.



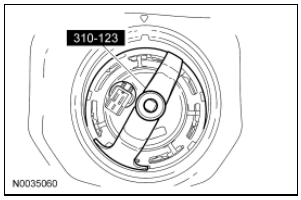
4. Attach the fuel storage tanker to the fuel drain hose and remove any residual fuel in the fuel tank filler pipe.
5. Remove the rear seat bottom and any insulation padding covering the fuel transfer pump access cover. For additional information, refer to Section 501-10 .
6. Remove the fuel transfer pump access cover.



7. Disconnect the electrical connector from the fuel transfer pump module.



8. Loosen the right fuel tank support strap approximately one inch.
9. Loosen the left fuel tank support strap approximately one inch.
10. Using the special tool, remove the fuel transfer pump lock ring.



11. Partially raise the fuel transfer pump and disconnect the internal fuel crossover tube quick connect couplings and remove the fuel transfer pump.
    - Remove and discard the fuel transfer pump O-ring seal.

Installation

1. **NOTE:** Make sure that the fuel crossover tubes are routed correctly.

   Position the fuel transfer pump and connect the internal fuel crossover tube quick connect couplings.

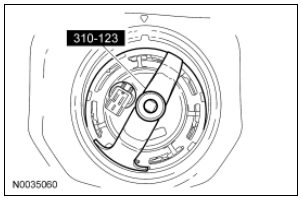
2. ⚠ **CAUTION: Inspect the surfaces of the fuel transfer pump flange and fuel tank O-ring seal contact surfaces. Do not polish or adjust the O-ring seal contact area of the fuel tank flange or the fuel tank. Install a new fuel transfer pump or fuel tank if the O-ring seal contact area is bent, scratched or corroded.**

   NOTE: Make sure the alignment arrows on the fuel transfer pump and the fuel tank meet before tightening the fuel transfer pump lock ring.

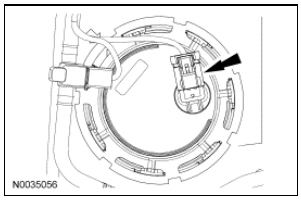
   NOTE: Apply clean engine oil to the O-ring seal.

   Using the special tool, install the fuel transfer pump and lock ring.

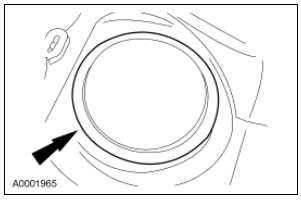
   - Install a new fuel transfer pump O-ring seal.
   - To install, tighten the fuel transfer pump lock ring until the lock tabs are seated against the stops.



3. Connect the electrical connector on the fuel transfer pump.



4. Install the fuel pump module access cover.



5. Install the rear seat bottom and any insulation padding covering the access covers. For additional information, refer to Section 501-10 .

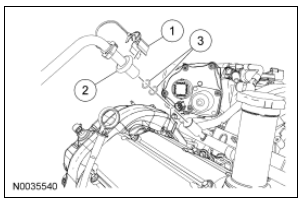
6. Tighten the 2 fuel tank support strap bolts.
   - Tighten to 35 Nm (26 lb-ft).

7. Connect the battery ground cable. For additional information, refer to Section 414-01 .

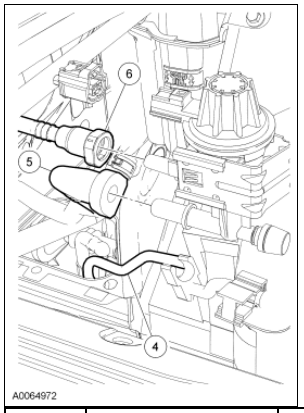
8. Turn the ignition key to the ON position to pressurize the fuel system.

9. Visually inspect the fuel system for leaks.

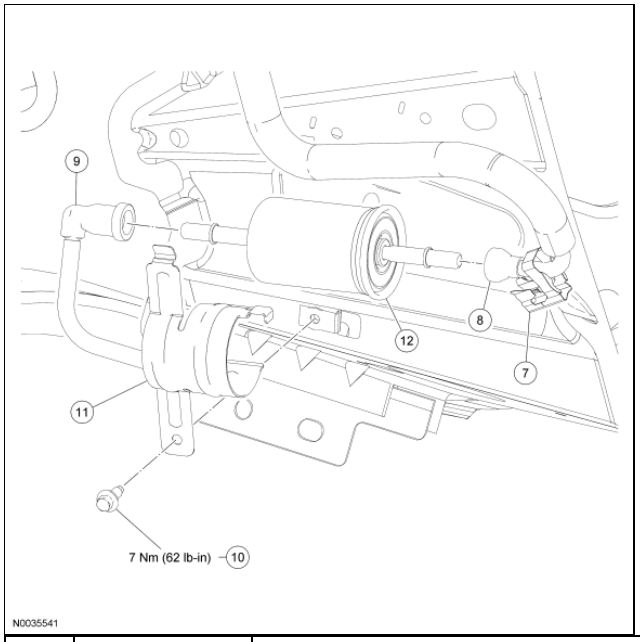
Fuel Lines and Fuel Filter — Exploded View



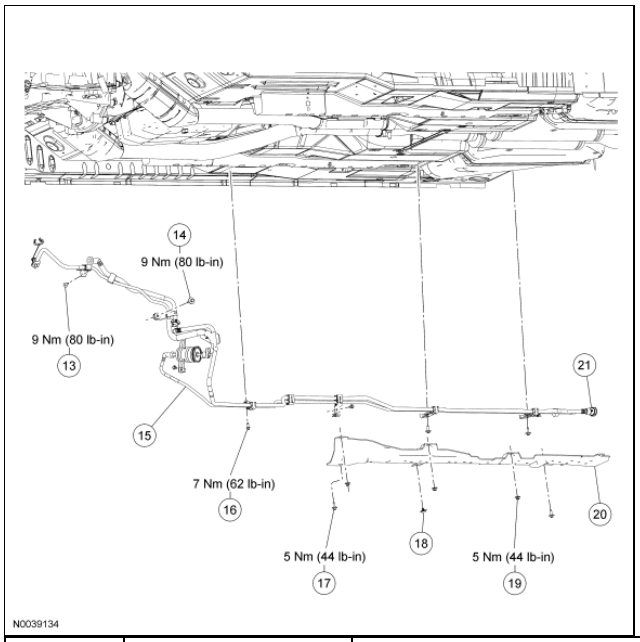
Item	Part Number	Description
1	9294	Fuel tube spring lock coupling safety clip (part of 9J280)
2	—	Spring lock coupling (part of 9J280)
3	9J274	Fuel tube spring lock coupling O-ring seals (2 required)



Item	Part Number	Description
4	9D676	Fuel tube
5	—	Vapor tube quick connect coupling (part of 9J274)
6	—	Vapor tube quick connect coupling (part of 9J274)



Item	Part Number	Description
7	—	Fuel tube spring lock coupling safety clip (part of 9J280)
8	—	Fuel tube quick connect coupling (part of 9J280)
9	—	Fuel tube quick connect coupling (part of 9S284)
10	W500212	Fuel filter bracket mounting bolt
11	9180	Fuel filter bracket
12	9155	Fuel filter



Item	Part Number	Description
13	W705549	Fuel hose bracket mounting bolt
14	N803882	Fuel hose bracket mounting bolt
15	9S284	Fuel tube
16	W500212	Fuel tube mounting bolt (5 required)
17	W503924	Fuel tube shield mounting bolt

18	—	Fuel tube shield pin-type retainer
19	N804795	Fuel tube shield mounting nut (3 required)
20	9C291	Fuel tube shield
21	—	Fuel vapor tube quick connect coupling (part of 9J274)

1. For additional information, refer to the procedures in this section.

Fuel Lines

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

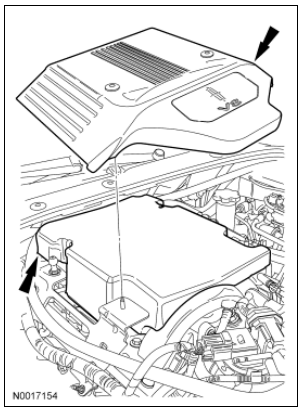
2. Release the fuel system pressure. For additional information, refer to Section 310-00 .

3. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

4. Remove the left front wheel well rear splash shield.

5. **⚠ CAUTION: The engine appearance cover is equipped with a noise suppressor. If the noise suppressor becomes separated from the engine appearance cover it must be positioned on the intake manifold prior to installing the engine appearance cover.**

   Remove the engine appearance cover and the noise suppressor (if detached).



6. Disconnect the fuel hose safety clip and spring lock coupling from the fuel rail. For additional information, refer to Section 310-00 .

7. Disconnect the 2 vapor tube quick connect couplings from the evaporative canister purge valve. For additional information, refer to Section 310-00 .

8. Remove the 2 fuel tube mounting bolts.
   - To install, tighten to 9 Nm (80 lb-in).

9. Disconnect the vapor tube quick connect couplings from the fuel vapor tube. For additional information, refer to Section 310-00 .

10. Disconnect the fuel tube quick connect and spring lock couplings from both sides of the fuel filter. For additional information, refer to Section 310-00 .

11. Remove the fuel filter bracket mounting bolt, fuel filter bracket and the fuel filter.
    - To install, tighten to 7 Nm (62 lb-in).

12. Remove the 2 fuel tube shield mounting bolts.
    - To install, tighten to 5 Nm (44 lb-in).

13. Remove the fuel tube shield pin-type retainer.

14. Remove the 3 fuel tube shield nuts and the fuel tube shield.
    - To install, tighten to 5 Nm (44 lb-in).

15. Disconnect the fuel tube quick connect coupling from the fuel tank supply tube. For additional information, refer to Section 310-00 .

16. Disconnect the vapor tube quick connect couplings from the fuel vapor control tube assembly valve. For additional information, refer to Section 310-00 .

17. Remove the 4 fuel tube mounting bolts and the fuel tube assembly.
    - To install, tighten to 7 Nm (62 lb-in).

18. To install, reverse the removal procedure.

Fuel Filter

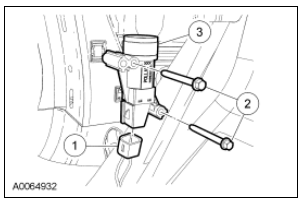
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Release the fuel system pressure. For additional information, refer to Section 310-00 .
3. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
4. Remove the left front wheel well rear splash shield.
5. Disconnect the fuel tube quick connect coupling from the inlet side of the fuel filter. For additional information, refer to Section 310-00 .
6. Disconnect the fuel tube spring lock coupling from the outlet side of the fuel filter. For additional information, refer to Section 310-00 .
7. **CAUTION: Some fuel will remain in the fuel filter after disconnecting. Carefully drain the remaining fuel into a suitable container.**

   Remove the fuel filter bracket mounting bolt, fuel filter bracket and the fuel filter.

   - To install, tighten to 7 Nm (62 lb-in).
8. To install, reverse the removal procedure.

Inertia Fuel Shutoff (IFS) Switch



Item	Part Number	Description
1	14A464	Inertia fuel shutoff switch (IFS) electrical connector
2	W504148	IFS mounting bolts
3	9341	Inertia fuel shutoff switch

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Remove the left-hand lower A-pillar trim panel.
3. Disconnect the inertia fuel shutoff switch electrical connector.
4. Remove the 2 bolts and the inertia fuel shutoff switch.
5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Accelerator pedal mounting nuts	9	80

Acceleration Control

The acceleration control consists of an accelerator pedal and sensor assembly.

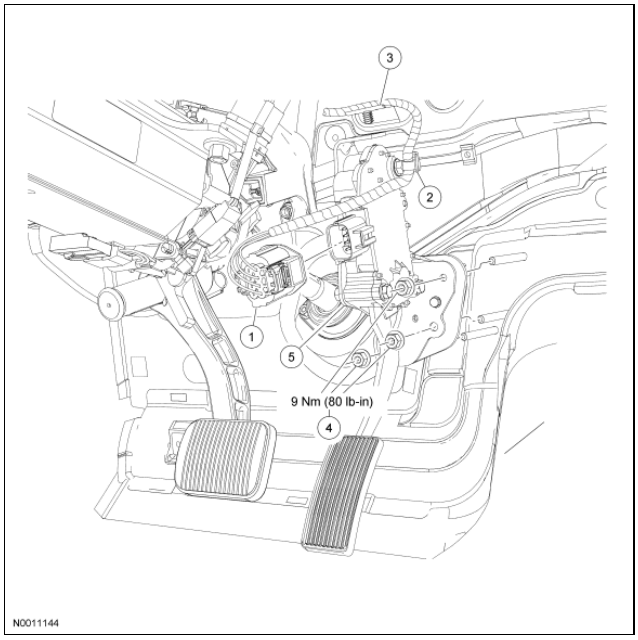
The engine management system electronically operates the throttle of the engine in response to throttle pedal movements initiated by the driver. In the event of a system failure, the engine management system provides a "limp home" mode which allows the car to be driven with limited performance.

Acceleration Control

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

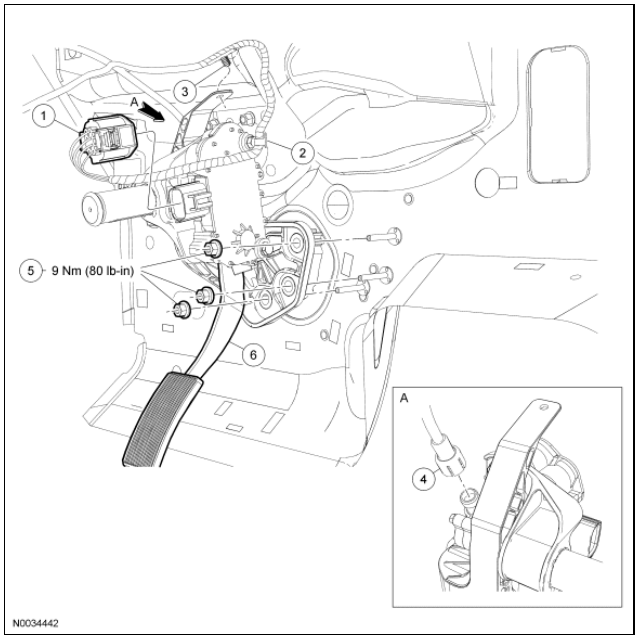
Accelerator Pedal

Fixed Pedal



Item	Part Number	Description
1	14A464	Accelerator pedal electrical connector
2	7047-3144-30	Accelerator pedal wiring harness retainer
3	13A506	Accelerator pedal pin-type wiring harness retainer
4	N806385	Accelerator pedal mounting nuts (3 required)
5	9F836	Fixed accelerator pedal

Adjustable Pedal



Item	Part Number	Description
1	14A464	Accelerator pedal electrical connector
2	7047-3144-30	Accelerator pedal wiring harness retainer
3	13A506	Accelerator pedal wiring harness pin-type retainer
4	2C430	Accelerator pedal drive motor cable retainer clip
5	N806385	Accelerator pedal mounting nuts
6	9F836	Adjustable accelerator pedal

Removal and Installation

All pedals

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Disconnect the accelerator pedal electrical connector.
3. Remove the accelerator pedal wiring harness retainer from the accelerator pedal bracket bolt.
4. Remove the accelerator pedal wiring harness pin-type retainer from the accelerator pedal bracket.

Adjustable pedal

5. Disconnect the accelerator drive cable from the accelerator pedal.

All pedals

6. Remove the 3 accelerator pedal retaining nuts.
   - To install, tighten to 9 Nm (80 lb-in).
7. Remove the accelerator pedal.
8. To install, reverse the removal procedure.

Adjustable pedal

9. Index the pedals. For additional information, refer to Section 206-06 .

Torque Specifications

Description	Nm	lb-in
Speed control switch screws	7	62

Speed Control

The speed control system is controlled by the powertrain control module (PCM). The speed control system is designed to maintain a selected vehicle speed between 48 and 200 km/h (30 and 124 mph).

The speed control system is controlled by the steering wheel-mounted switches (ON, OFF, SET+, SET-, RESUME, and CANCEL), and the brake pedal. The steering wheel-mounted switches are backlit.

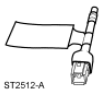
The speed control functions include:

- turning on the speed control system.
- setting and maintaining the desired vehicle speed.
- accelerating the vehicle speed.
- tapping-up/tapping-down the vehicle speed.
- resuming the prior vehicle speed.
- turning off the vehicle speed control system.
- canceling the speed control.

Speed Control

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2512-A	Restraint System Diagnostic Tool 418-F403
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent scan tool

Principles of Operation

Pressing and releasing the ON switch turns the system on. Pressing and releasing the SET+ or SET- switch while the vehicle is traveling at the desired speed activates the system. The vehicle maintains the desired speed.

Tapping the SET+ or SET- buttons, while in the set mode respectively, increases or decreases the maintained vehicle speed by 2 km/h (1 mph) per tap. If the respective button is pressed and held, the vehicle speed continues to accelerate or decelerate until the button is released.

Pressing and releasing the OFF switch, or positioning the ignition switch in the OFF position, turns the speed control off. Pressing the brake pedal or pressing the CANCEL button puts the system in the STANDBY mode. Pressing the RESUME button, when the system is in STANDBY mode causes the vehicle to accelerate until the last set speed is resumed. Resume does not function if the OFF button is pressed, the ignition switch is in the OFF position, or if the current vehicle speed is below the minimum operational speed.

Whenever the speed control system is engaged and active, a speed control illuminator is set.

The inputs to the powertrain control module (PCM) for the speed control system are the:

- Output shaft sensor (OSS)
- Digital transmission range (TR) sensor
- Speed control deactivator switch
- Stoplamp switch
- Speed control switches

The outputs from the PCM for the speed control system are the:

- Instrument cluster

- Throttle command

The speed control system does not require an electronic actuator for electronic throttle control (ETC) vehicles. Throttle position is completely controlled by the PCM through the electronic throttle body. Speed control electronics are contained entirely within the ETC subsystem.

When the speed control is active, the electronic actuator corrects for deviations in the actual vehicle speed by proportionally moving the throttle plate. The control electronics modulate the throttle to minimize error between actual vehicle speed and the desired speed.

The PCM strategy uses the engine control for smooth accelerations. In instances where the vehicle tends to exceed set speed, the PCM invokes an engine braking strategy to help maintain the desired vehicle speed.

The PCM sends a requested controller area network (CAN) vehicle speed control set speed message (enable/disable) whenever the speed control set indicator should be turned on or off.

The driver commands the speed control system by pressing steering wheel mounted switches. The steering wheel switches are hardwired to the PCM.

The speed control system operates in the following modes:

- STANDBY
- OFF
- VS CONTROL
- TAP UP
- TAP DOWN
- ACCEL
- DECEL
- RESUME

When the speed control is in the ON mode, and the PCM receives a SET+ or SET- switch input, the speed control system enters into the SET mode and maintains present vehicle speed (provided the vehicle speed is within the system operating range). When the PCM receives a SET+ switch input, the speed control system will accelerate the vehicle at approximately 1.5 mph/sec (on level roads). The speed control system continues to accelerate the vehicle until the switch is no longer pressed and then will maintain that vehicle speed. If the duration of the switch input is less than 640 ms the speed control system will increase vehicle speed by 2 km/h (1 mph). When the system is in the STANDBY mode, and a RESUME command input is received, the speed control subsystem transitions into SET mode and modifies vehicle speed to resume the last SET vehicle speed, provided the speed control system has previously been in the SET mode subsequent to the key on last cycle.

When the PCM receives a SET- switch input, the speed control system will decrease vehicle speed at approximately 1.5 mph/sec (on level roads). Once the switch is no longer pressed, the speed control system ceases vehicle deceleration and maintains present vehicle speed. If the duration of the switch input is less than 640 ms, the speed control system will decrease vehicle speed by 2 km/h (1 mph).

In the event of an OFF command or a deactivation request from any source, except the cancel switch, the system will carry out a hard deactivation and immediately return the throttle to the idle position.

In the event of a CANCEL command input, the system will deactivate and return the throttle to the idle position at a smooth and controlled rate.

NOTE: The speedometer does not use the same signal as the speed control system.

The speed control system provides self-diagnostics. Speed control is disabled anytime an error is detected in the system. No cluster telltale or message center messages are displayed when faults occur. Fault codes will be logged by the PCM.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Speed control switch • Electronic throttle body • Stoplamp switch • Speed control deactivator switch	• Central junction box (CJB) fuse 35 (5A) • Underhood auxiliary junction box (AJB) fuse 6 (15A) • Circuitry • Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. Verify the speedometer operates correctly without speed control by test driving the vehicle. If the speedometer does not operate correctly, refer to Section 413-01 .

5. Verify the stoplamps operate correctly with the ignition switch in the OFF position. If the stoplamps do not operate correctly, refer to Section 417-01 .

6. Verify the brake warning indicator operates correctly. If the brake warning indicator does not operate correctly, refer to Section 413-01 .

7. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - verify that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

8. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

9. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP, CAN, ISO, or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for PCM, refer to Section 418-00 .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out the self-test diagnostics for the PCM.

10. If the DTCs retrieved are related to the concern, go to the Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index.

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

NOTE: DTC P1572 and DTC P1703 must be repaired before any other DTC.

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index

DTCs	Description	Source	Action
P0500	Vehicle Speed Error	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0579	Cruise Control Multifunction Input A Circuit Range/Performance	PCM	GO to Pinpoint Test C .
P0581	Cruise Control Multifunction Circuit High	PCM	GO to Pinpoint Test C .
P1572	Brake On/Off Failure	PCM	GO to Pinpoint Test B .
P1703	Brake On/Off Failure	PCM	GO to Pinpoint Test B .

Symptom Chart

Symptom Chart

Pinpoint Test

Pinpoint Test A: The Speed Control Is Inoperative

Normal Operation

The powertrain control module (PCM) sends a signal through circuit 7-PG24 (YE/BU) to the speed control switch, which passes through the clockspring. The return signal is sent through circuit 31S-PG24 (BK/OG)/31S-PG1 (BK/BU) and the clockspring.

Possible Causes

- PCM not configured for speed control
- Speed control switch
- Digital transmission range (TR) sensor
- PCM

PINPOINT TEST A: THE SPEED CONTROL IS INOPERATIVE

Test Step	Result / Action to Take
A1 VERIFY POWERTRAIN CONTROL MODULE (PCM) CONFIGURATION	

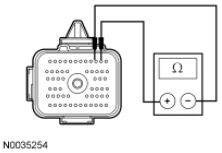
<table>
<tr><td>• Enter the following diagnostic mode on the scan tool: Programmable Parameters.
• Verify that the speed control is enabled in the PCM.
• Is the speed control enabled?</td><td>Yes
GO to A2 .

No
ENABLE the speed control in the PCM using the scan tool programmable parameters menu. If no parameter exists, REFER to Section 418-01 to carry out PCM programmable module installation (PMI). TEST the system for normal operation.</td></tr>
<tr><td>A2 RETRIEVE THE RECORDED PCM DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS</td><td></td></tr>
<tr><td>• Check for recorded PCM DTCs from the continuous and on-demand self-tests.
• Are any DTCs recorded?</td><td>Yes
REFER to the Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index.

No
GO to A3 .</td></tr>
<tr><td>A3 CHECK THE SPEED CONTROL SWITCH</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: PCM C175b.
• Measure the resistance between the PCM C175b-57, circuit 7-PG24 (YE/BU), harness side and the PCM C175b-56, circuit 31S-PG24 (BK/OG), harness side while pressing the speed control switches as follows:

<table><tr><th>Speed Control Switch</th><th>Resistance Value</th></tr><tr><td>Cancel</td><td>114 - 126 ohms</td></tr><tr><td>SET-</td><td>285 - 315 ohms</td></tr><tr><td>SET+</td><td>570 - 630 ohms</td></tr><tr><td>Resume</td><td>1,055 - 1,165 ohms</td></tr><tr><td>On</td><td>2,004 - 2,216 ohms</td></tr><tr><td>Off</td><td>Less than 5 ohms</td></tr></table></td><td>Yes
GO to A4 .

No
GO to Pinpoint Test C .</td></tr>
</table>

 N0035254 • **Are the speed control switch resistance values OK?**	
A4 CHECK THE DIGITAL TR SENSOR	
• Connect: PCM C175b. • Apply the parking brake. • Ignition ON. • Enter the following diagnostic mode on the scan tool: PCM Digital TR Sensor PID. • Monitor the PCM digital TR sensor PID. • Select DRIVE. • **Does the PID value agree with the transmission range selector lever position?**	**Yes** GO to A5 . **No** REFER to Section 307-01 to continue diagnosis of the digital TR sensor.
A5 CHECK THE DIGITAL TR SENSOR FOR CORRECT ALIGNMENT	
• Check the digital TR sensor alignment. Refer to Section 307-01 . • **Is the digital TR sensor aligned correctly?**	**Yes** GO to A6 . **No** ADJUST the digital TR sensor. REFER to Section 307-01 . TEST the system for normal operation.
A6 CHECK THE BRAKE WARNING INDICATOR	
• Ignition ON. • While observing the brake warning indicator, apply and release the parking brake. • **Does the brake warning indicator operate correctly?**	**Yes** GO to A7 . **No** REFER to Section 413-01 to continue diagnosis of the brake warning indicator.
A7 CHECK THE VEHICLE SPEED	
NOTE: This step may require an assistant. • Enter the following diagnostic mode on the scan tool: Anti-lock Brake System (ABS) Wheel Speed PID. • Monitor and record the ABS module wheel speed PID while driving the vehicle at 48 km/h (30 mph) as indicated on the speedometer. • Enter the following diagnostic mode on the scan tool: PCM Vehicle Speed PID. • Monitor and record the PCM vehicle speed PID while driving the vehicle at 48 km/h (30 mph) as indicated on the speedometer.	**Yes** GO to A8 . **No** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the output shaft speed (OSS) sensor signal.

• **Does the speed indicated by the ABS module wheel speed PID match the PCM vehicle speed PID?**	
A8 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the PCM connectors and make sure they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC P1572 or DTC P1703 — Brake On/Off Circuit Failure

Normal Operation

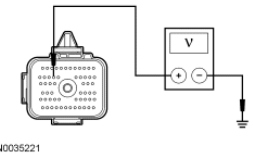
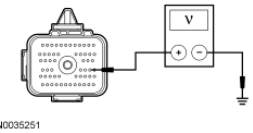
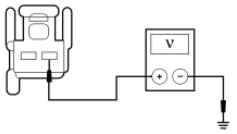
When the brake pedal is applied, the stoplamp switch supplies voltage to the powertrain control module (PCM) through circuit 29S-CF1 (OG/BU) to indicate that the brake pedal is applied. When the PCM senses the voltage from the stoplamp switch, the speed control is deactivated. The speed control deactivator switch interrupts the power signal to the PCM through circuit 15S-RE25 (GN/OG) when the brake pedal is applied firmly and passes the stoplamp switch trip point. This is a redundant signal to the PCM.

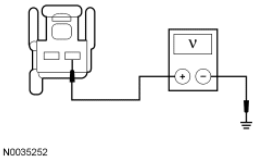
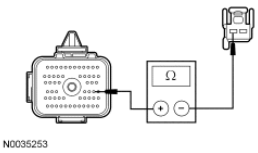
Possible Causes

- Fuse
- Circuit 15S-PG6 (GN/YE) open
- Circuit 15S-RE25 (GN/OG) open or short to voltage
- Circuit 29S-RE13 (OG) open or short to voltage
- Speed control deactivator switch

PINPOINT TEST B: DTC P1572 OR DTC P1703 — BRAKE ON/OFF CIRCUIT FAILURE

Test Step	Result / Action to Take
B1 CHECK STOPLAMPS OPERATION	
• Press the brake pedal and observe the stoplamps. • **Do the stoplamps illuminate?**	**Yes** GO to B2 . **No** REFER to Section 417-01 to continue diagnosis of the stoplamps.
B2 CHECK CIRCUIT 29S-RE13 (OG) FOR VOLTAGE	
• Ignition OFF. • Disconnect: PCM C175b. • Ignition ON.	**Yes** GO to B3 . **No** REPAIR the circuit. CLEAR the DTCs.

• Measure the voltage between the PCM C175b-40, circuit 29S-RE13 (OG), harness side and ground.  N0035221 • **Is any voltage present?**	REPEAT the self-test.
B3 CHECK THE SPEED CONTROL DEACTIVATOR SWITCH FOR CORRECT OPERATION	
• While firmly applying and releasing the brake pedal, measure the voltage between the PCM C175b-28, circuit 15S-RE25 (GN/OG), harness side and ground.  N0035251 • **Is the voltage greater than 10 volts with the brake pedal released and 0 volts with the brake pedal firmly applied?**	**Yes** GO to B7 . **No** GO to B4 .
B4 CHECK CIRCUIT 15S-PG6 (GN/YE) FOR AN OPEN	
• Ignition OFF. • Disconnect: Speed Control Deactivator Switch C277. • Ignition ON. • Measure the voltage between the speed control deactivator switch C277-1, circuit 15S-PG6 (GN/YE), harness side and ground.  N0035252 • **Is the voltage greater than 10 volts?**	**Yes** GO to B5 . **No** VERIFY the auxiliary junction box (AJB) fuse 6 (15A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B5 CHECK CIRCUIT 15S-RE25 (GN/OG) FOR A SHORT TO VOLTAGE	

• Measure the voltage between the speed control deactivator switch C277-2, circuit 15S-RE25 (GN/OG), harness side and ground.  N0035252 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B6 .
B6 CHECK CIRCUIT 15S-RE25 (GN/OG) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the speed control deactivator switch C277-2, circuit 15S-RE25 (GN/OG), harness side and the PCM C175b-28, 15S-RE25 (GN/OG), harness side.  N0035253 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new speed control deactivator switch. REFER to Speed Control Deactivator Switch in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B7 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the PCM connectors and make sure they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTC P0579 or DTC P0581 — Speed Control Switch Circuit Failure

Normal Operation

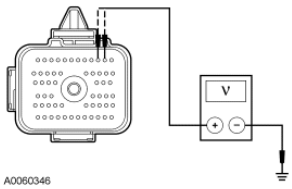
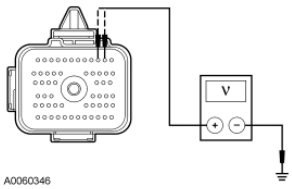
The powertrain control module (PCM) sends a signal through circuit 7-PG24 (YE/BU) to the speed control switch, which passes through the clockspring. The return signal is sent through circuit 31S-PG24 (BK/OG)/31S-PG1 (BK/BU) and the clockspring.

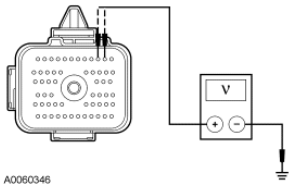
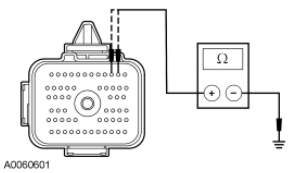
Possible Causes

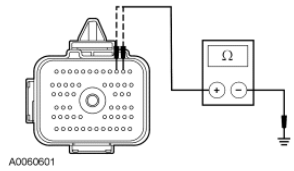
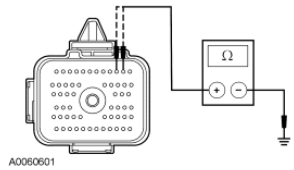
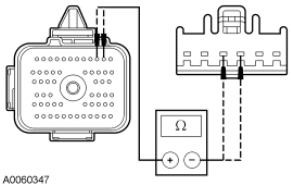
- Circuit 7-PG24 (YE/BU) open, short to voltage, or short to ground
- Circuit 31S-PG1 (BK/BU) open, short to voltage, or short to ground

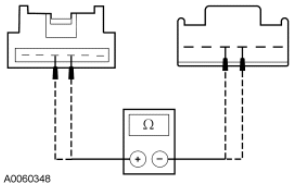
- Circuit 31S-PG24 (BK/OG) open, short to voltage, or short to ground
- Clockspring
- PCM
- Speed control switch

PINPOINT TEST C: DTC P0579 OR DTC P0581 — SPEED CONTROL SWITCH CIRCUIT FAILURE

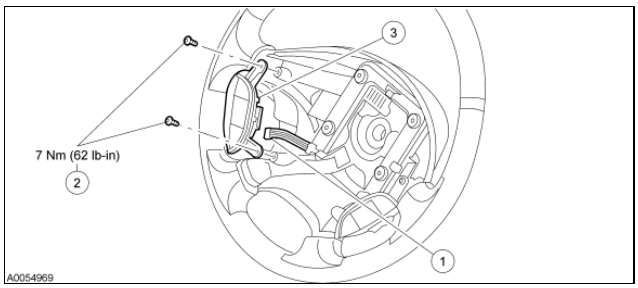
Test Step	Result / Action to Take
C1 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: PCM C175b. • Ignition ON. • Turn the parking lamps on. • Measure the voltage between the PCM C175b-56, circuit 31S-PG24 (BK/OG), harness side and ground; and between the PCM C175b-57, circuit 7-PG24 (YE/BU), harness side and ground.  • **Is any voltage present?**	**Yes** TURN the parking lamps off. GO to C2 . **No** TURN the parking lamps off. GO to C4 .
C2 CHECK CIRCUITS 7-PG24 (YE/BU) AND 31S-PG24 (BK/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Clockspring C218a. • Ignition ON. • Measure the voltage between the PCM C175b-56, circuit 31S-PG24 (BK/OG), harness side and ground; and between the PCM C175b-57, circuit 7-PG24 (YE/BU), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to C3 .
C3 CHECK THE CLOCKSPRING FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Connect: Clockspring C218a. • ⚠ **WARNING: Make sure there is no one inside the vehicle and that there is nothing blocking or set in front of any air bag module when the battery is connected. Failure to follow these instructions may result in personal injury.** • Remove the driver air bag module. Refer to Section 501-20B . • Connect the restraint system diagnostic tool to the upper clockspring air bag connector. • Disconnect: Upper Clockspring. • Connect the battery. • Ignition ON. • Turn the parking lamps on. • Measure the voltage between the PCM C175b-56, circuit 31S-PG24 (BK/OG), harness side and ground; and between the PCM C175b-57, circuit 7-PG24 (YE/BU), harness side and ground.  A0060346 • **Is any voltage present?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new speed control switch. REFER to Speed Control Switch in this section. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
C4 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Audio Unit C290b. • Measure the resistance between the PCM C175b-56, circuit 31S-PG24 (BK/OG), harness side and ground; and between the PCM C175b-57, circuit 7-PG24 (YE/BU), harness side and ground.  A0060601 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to C7 . **No** GO to C5 .
C5 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND	
• ⚠ **WARNING: Make sure there is no one inside the vehicle and that there is nothing blocking or set in front of any air bag module when the battery is connected. Failure to follow these instructions may result in personal**	**Yes** INSTALL a new speed control switch. REFER to Speed Control Switch in this section. INSTALL the driver air bag module. REFER

injury. • Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring. • Measure the resistance between the PCM C175b-56, circuit 31S-PG24 (BK/OG), harness side and ground; and between the PCM C175b-57, circuit 7-PG24 (YE/BU), harness side and ground.  A0060601 • **Are the resistances greater than 10,000 ohms?**	to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** GO to C6 .
C6 CHECK CIRCUITS 7-PG24 (YE/BU) AND 31S-PG24 (BK/OG) FOR A SHORT TO GROUND	
• Disconnect: Clockspring C218b. • Ignition OFF. • Measure the resistance between the PCM C175b-56, circuit 31S-PG24 (BK/OG), harness side and ground; and between the PCM C175b-57, circuit 7-PG24 (YE/BU), harness side and ground.  A0060601 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit(s) in question. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test
C7 CHECK CIRCUITS 7-PG24 (YE/BU) AND 31S-PG24 (BK/OG) FOR AN OPEN	
• Measure the resistance between the PCM C175b-56, circuit 31S-PG24 (BK/OG), harness side and the clockspring C218a-3, circuit 31S-PG24 (BK/OG), harness side; and between the PCM C175b-57, circuit 7-PG24 (YE/BU), harness side and the clockspring C218a-4, circuit 7-PG24 (YE/BU), harness side.  A0060347 • **Are the resistances less than 5 ohms?**	**Yes** GO to C8 . **No** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

C8 CHECK THE CLOCKSPRING	
• **⚠ WARNING: Make sure there is no one inside the vehicle and that there is nothing blocking or set in front of any air bag module when the battery is connected. Failure to follow these instructions may result in personal injury.** • Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring. • Measure the resistance between the clockspring connector C218a pin 3, component side and the upper clockspring connector pin 3, component side; and between the clockspring C218a pin 4, component side and the upper clockspring connector pin 4, component side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to C9 . **No** INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
C9 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the PCM connectors and make sure they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . INSTALL the driver air bag. REFER to Section 501-20B . REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. INSTALL the driver air bag. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

Speed Control Switch



Item	Part Number	Description
1	14A005	Speed control switch electrical connector
2	W705342-S424	Speed control switch screws (2 required)
3	9C888	Speed control switch

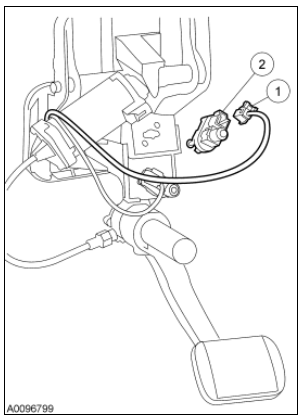
Removal and Installation

1. Remove the driver air bag module. For additional information, refer to Section 501-20B .

2. Remove the 2 screws and the speed control switch.
   - Disconnect the electrical connector.
   - To install, tighten to 7 Nm (62 lb-in).

3. To install, reverse the removal procedure.

Speed Control Deactivator Switch



Item	Part Number	Description
1	14A005	Speed control deactivator switch electrical connector
2	9F924	Speed control deactivator switch

Removal

1. Disconnect the speed control deactivator switch electrical connector.
2. Rotate the speed control deactivator switch counterclockwise 45 degrees and remove it from the bracket.

Installation

1. While applying the brake pedal, install the speed control deactivator switch in the bracket and rotate it 45 degrees clockwise.
2. Connect the electrical connector.

Acronyms

CHT - Cylinder Head Temperature

DLC - Data Link Connector

ECT - Engine Coolant Temperature

EONV - Engine Off Natural Vacuum

EPC - Electronic Pressure Control

ETB - Electronic Throttle Body

EVAP - Evaporative Emission

FP - Fuel Pump

FTP - Fuel Tank Pressure

IC - Instrument Cluster

IKT - Integrated Keyhead Transmitter

MAF - Mass Air Flow

MIL - Malfunction Indicator Lamp

O/D - Overdrive

OBD - On-Board Diagnostic

OCS - Occupant Classification Sensor

OCSM - Occupant Classification System Module

ORVR - On-Board Refueling Vapor Recovery

OTA - Oil-To-Air

OWC - One-Way Clutch

PATS - Passive Anti-Theft System

RCM - Restraints Control Module

RKE - Remote Keyless Entry

SRS - Supplemental Restraint System

TB - Throttle Body

TCC - Torque Converter Clutch

TFT - Transmission Fluid Temperature

TP - Throttle Position

TPMS - Tire Pressure Monitoring System

TXV - Thermostatic Expansion Valve

VC - Vehicle Certification

VCM - Vehicle Communication Module

VCT - Variable Camshaft Timing

VIN - Vehicle Identification Number

VSS - Vehicle Speed Sensor

WOT - Wide Open Throttle

Material

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	—	—
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®	—

General Specifications

Item	Specification
Power Steering Gear	
Static steering wheel turning effort	3.7 Nm (33 lb-in)
Turns lock-to-lock	2.74
Power Steering Pump	
Flow @ 1,500 rpm	9.00 ± 0.75L/min (2.4 ± 0.2 gpm) Fluid temp. 74-80°C (165-176°F) Engine speed set to 1,500 rpm (with no steering input) Power steering analyzer set @ 1000 kPa (145 psi)
Minimum capacity	4.0 L/min (1.0 gpm) @ 4,999 kPa (725 psi) @ 500 rpm
Relief pressure	11,197-11,997 kPa (1,624-1,740 psi)
Power Steering Purge Vacuum	
Air purge vacuum	68-85 kPa (20-25 in-Hg)

Steering System

The power steering system consists of:

- power steering pump.
- fluid reservoir.
- rack-and-pinion steering gear.
- fluid cooler.
- power steering pressure and return lines/hoses.
- variable assist power steering (VAPS) actuator.

Steering System

Special Tool(s)

ST1300-A	100W/12 Volt DC UV Lamp 164-R0751
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST1396-A	Dial Thermometer 32°C-104°C (0-220°F) 023-R0007 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	—
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Principles of Operation

Power Steering

The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid is pulled into the pump from the reservoir. The power steering fluid is trapped between the pump vanes and moved to the high-pressure side of the pump, creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high-pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid before returning it to the pump.

Variable Assist Power Steering (VAPS)

The variable assist power steering (VAPS) system controls the level of power assistance available to the driver based on vehicle speed. At less than 3.2 km/h (2 mph), full power steering assist is provided to decrease steering efforts and increase maneuverability. Between 3.2 km/h (2 mph) and 191 km/h (119 mph), steering assist decreases gradually at a calibrated rate to raise steering efforts for increased directional stability and greater road feel. At greater than 191 km/h (119 mph), steering assist is constant.

The front electronic module (FEM) outputs a pulse-width modulated (PWM) current to the control valve actuator. The control valve actuator controls the hydraulic valve that determines the amount of hydraulic assist provided to the steering gear. The amount of assistance provided varies with the control valve actuator current, which is based on vehicle speed according to a look-up table internal to the FEM. The FEM pulse-width modulates the control valve actuator current to provide the desired amount of assistance. The amount of hydraulic steering assistance provided by the VAPS subsystem is proportional to the average control valve current.

The vehicle speed is provided to the FEM through the standard corporate protocol (SCP) network from the ABS module.

The engine rpm is provided to the FEM through the SCP network from the PCM. The FEM uses the engine rpm to determine if the engine is running. The FEM only outputs control valve actuator current when the engine is running to minimize noise, vibration or harshness when the engine is off. The FEM assumes the engine is running only if the engine rpm is greater than 100 rpm.

Upon starting the engine, the FEM provides a 200 millisecond full-ON pulse followed by a 150 millisecond full-OFF pulse to the control valve actuator. Normal VAPS system operation begins after this cleaning stroke is complete. In the event the rpm signal is invalid from the PCM (less than 100 rpm) and the vehicle speed is less than 1.6 km/h (1 mph), the VAPS system does not carry out the cleaning stroke or apply current to the control valve actuator. When the engine speed exceeds 100 rpm, the system carries out the cleaning stroke and begins applying the calibrated current to the actuator.

Inspection and Verification

⚠ CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may result.

NOTE: Make the following preliminary checks before repairing the steering system:

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Fluid level • Tire pressure • Tires	• Wiring, terminals or connectors • Battery junction box (BJB) fuse 32 (30A)

• Drive belt • Drive belt tensioner • Steering column alignment • Tie-rod ends • Suspension components • Steering column shaft U-joints • Intermediate shaft bolts • Power steering reservoir baffle • Power steering reservoir screen • Power steering pressure lines, fittings or O-rings • Power steering return hoses and clamps • Steering gear • Power steering pump • Power steering pressure switch	• Central junction box (CJB) fuse 30 (5A) • Switch system power (SPP) relay 2 • Front electronic module (FEM) • ABS module • PCM • Battery/charging system

3. Inspect the power steering fluid for the following conditions:
   - Aeration or foam: Purge the power steering system. Refer to Power Steering System Purging in this section.
   - Overheating or contamination: Flush the power steering system. Refer to Power Steering System Flushing in this section.

4. **NOTE:** It may be necessary to add power steering fluid to achieve the correct level.

   Check the fluid level and clean the power steering components.
   With the ignition OFF:

   - check the power steering fluid level and add fluid as necessary.
   - wipe off any visible signs of fluid or residue build up.
   - ⚠ **CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

     Start the engine and turn the steering wheel from stop-to-stop several times.

5. Visually inspect the power steering hydraulic line/hose connections for leaks.

- If a leak is detected at a threaded fitting or clamp plate joint, tighten to specification. If the leak is still evident, visually inspect the O-rings or Teflon® seals. Install new O-rings or Teflon® seals as necessary. Refer to Section 211-02 .
- If a leak is detected at a constant tension spring clamp, verify that the hose is not damaged and fully installed on the hose fitting. Make sure that the constant tension spring clamp is correctly positioned. If the leak remains, install a new constant tension spring clamp.
- If a leak is detected at a screw clamp joint, verify that the hose is fully installed on the hose fitting before tightening the screw clamp. If the leak remains, install a new screw clamp. Refer to Section 211-02 .
- If a leak is detected at the power steering pressure switch, install a new switch. Refer to the appropriate section in Group 303 for the procedure.

6. Visually inspect the power steering components for leaks.

- If a leak is detected in the power steering pressure line or return hose, install a new hose. Refer to Section 211-02 .

- If a leak is detected in the power steering pump, install a new power steering pump. Refer to Section 211-02 .
- **NOTE:** On vehicles with rack and pinion steering gear, it may be necessary to remove the bellows boot clamp from the steering gear bellows boot to inspect for internal steering gear leaks.

  If a leak is detected in the steering gear, install a new steering gear. Refer to Section 211-02 .
- If a leak is detected in the power steering reservoir, install a new reservoir. Refer to Section 211-02 .

7. For information on power steering leak detection, refer to Component Tests in this section.

8. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

9. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

10. **NOTE:** The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

    If the scan tool does not communicate with the VCM:

    - check the VCM connection to the vehicle.
    - check the scan tool connection to the VCM.
    - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no communication with the scan tool.

11. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to Section 418-00 to diagnose no response from the PCM.

12. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record continuous memory DTCs.

13. Clear the continuous DTCs and carry out the self-test diagnostics for the front electronic module (FEM).

14. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) DTC Chart. For all other DTCs, refer to Section 419-10 .

15. If no DTCs related to the concern are retrieved, GO to Symptom Chart - Steering System or GO to Symptom Chart - Noise/Vibration .

Front Electronic Module (FEM) DTC Chart

DTC	Description	Source	Action
B1342	ECU is Defective	Front Electronic Module (FEM)	CLEAR the DTC. REPEAT the self-test. RETRIEVE the DTCs. If DTC B1342 is retrieved

			again, INSTALL a new FEM. REFER to Section 419-10 . REPEAT the self-test.
C1924	VAPS Solenoid Actuator Output Short to Ground	FEM	GO to Pinpoint Test A .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	GO to Pinpoint Test B .

Steering System Symptom Definitions

Drift/Pull

Pull is described as a tugging sensation felt by the hands on the steering wheel that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with the hands off the steering wheel.

- A vehicle-related drift/pull on a flat road can cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull can be induced by conditions external to the vehicle, such as wind or road camber.

Excessive Steering Wheel Play

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Lack of Assist or Inconsistent Assist

Lack of assist or inconsistent assist is experienced when the steering wheel effort is higher than normal. Hard steering can remain constant through the full turn or occur near the end of a turn. It is important to know the difference between hard steering/lack of assist and poor returnability/sticky steering.

Hard steering or lack of assist can result from either hydraulic or mechanical conditions. It is extremely important to know if this concern occurs during driving or during high-effort parking maneuvers.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or steering correction is completed.

Shimmy

Shimmy, as felt by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Steering System Noise Definitions

Belt Squeal

Belt squeal is a high frequency air-borne noise generated by accessory drive belt slippage on the power steering pump pulley. Squeal increases with system loading and at the steering stops.

Chirp

A short-duration high-pitched noise associated with a slipping drive belt.

Clonk

Clonk is a structure-borne noise heard as a loose-sounding rattle or vibration coming from the steering column. Clonk is identified by driving and turning over cobble stones, rough roads or high frequency bumps, such as 1-2 inch tall tar strips or frost heaves. Clonk is a noise heard only while cornering over bumps. Clonk requires a tie-rod load impact. Clonk can sound identical to Column Rattle, that also occurs when driving over cobble stones or rough road. Clonk may appear to emanate from a location closer to the floor than for column knock.

Clunk

A heavy or dull, short-duration, low-frequency sound that can be temperature sensitive. Clunk can occur when accelerating or decelerating abruptly. Also described as a thunk. Clunk can also occur when cornering over a bump.

Cold Start Noise

Cold start noise is the air-borne noise generated by pump cavitation when hydraulic fluid does not flow freely through the suction hose from the reservoir to pump. Zip is primarily a cold weather start-up phenomenon. Some noise during an extremely cold start (-12.2°C [-10°F]) is normal and should improve as the steering system warms up (usually within 60 seconds).

Column Rattle

Column rattle is a metallic sounding noise created when applying a highly impulsive force to the steering wheel. Column rattle is often used to combine the more general group of column noises including Clonk and Knock. Column rattle noises can be caused by clonk, knock, loose column components, extra loose parts such as fasteners or broken plastic pieces. A series of parked, straight-line driving and cornering tests must be used to isolate the source(s).

Hiss

Hiss or valve hiss is a high-frequency sound coming from the steering gear when the system is loaded. It is a rushing or "swish" noise that does not change frequency with rpm. Hiss is the general noise generated by flow of hydraulic fluid though restrictions in the steering system and typically worsens with increasing temperatures. Restrictions include the rotary steering valve, power steering tubes, connectors or tuning orifices. Hiss can be air-borne and structure-borne, but the structure-borne path through the steering intermediate shaft is usually dominant.

Grinding

Grinding is a low frequency noise in the column when the steering wheel is turned. This is generally caused by interference between moving components, such as steering wheel to shroud.

Grunt (Squawk)

Grunt is a "honking" sound elicited when coming off one of the steering stops. The phenomenon may also be tactile. Grunt is a structure-borne noise (and vibration) generated at the steering valve. Grunt frequency is system dependent and in the range of 30 Hz to 200 Hz. Grunt is generally excited during parking maneuvers with a low-speed to medium-speed steering input.

Knock

Knock is a loose-sounding rattle or vibration generated by the steering column shaft contacting other portions of the column assembly. The noise is both audible and tactile. Knock is generated driving over cobble stones or rough pavement. It is not necessary to turn the steering wheel to create this noise.

Moan

Moan is the general structure-borne noise of the steering system. Moan is typically in the frequency range of 100 Hz to 600 Hz. Moan is primarily transmitted to the driver via body structure, through the pump mount, engine mounts, power steering lines and brackets. For problem vehicles, moan is a loud humming noise, often present when the wheel is turned and the system is loaded. It may change in frequency with rpm and if the system is loaded or unloaded.

Shudder

Shudder is a low frequency (10-20 Hz) oscillation of the entire steering system (tires, wheels, steering gear and linkage, etc.) when the vehicle is steered during static park or at low speeds. Shudder is very dependent on road surface.

Squeak

Squeaks are noises due to friction or component rubbing anywhere in the steering system. Squeaks have appeared in steering linkage joints, in steering column components, steering gear rotary seals and steering wheel trim parts.

Whine

Whine is the general air-borne noise of the power steering pump. Whine is in the frequency range of 1 kHz to 4 kHz. Whine is generated when engine rpm, pump rotational natural frequency and pump/bracket natural vibration frequency align.

Whistle

Whistle is similar to hiss but is louder and of a higher frequency. It is also more of a pure tone noise than hiss. Whistle is air-borne and is generated by a high flow rate of hydraulic fluid through a small restriction.

Symptom Chart — Steering System

Symptom Chart — Steering System

Symptom Chart — Noise/Vibration

Symptom Chart — Noise/Vibration

Pinpoint Tests

Pinpoint Test A: DTC C1924 — VAPS Solenoid Actuator Output Short to Ground

Refer to Wiring Diagrams Cell 43 , Power Steering Controls for schematic and connector information.

Normal Operation

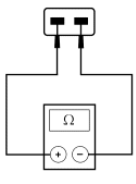
The front electronic module (FEM) sends the variable assist power steering (VAPS) solenoid a pulse-width modulated (PWM) current along circuit 8-CE9 (WH/GN). The VAPS solenoid sends a feedback voltage to the FEM module, depending on the power steering assist demand, along circuit 9-CE9 (BN/GN).

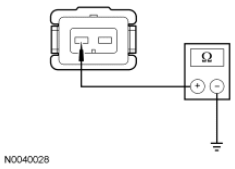
- DTC C1924 VAPS Solenoid Actuator Output Short to Ground — This DTC will be set whenever the VAPS Solenoid output is shorted to ground for at least 250 ms or longer.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- VAPS solenoid
- FEM

PINPOINT TEST A: DTC C1924 — VARIABLE ASSIST POWER STEERING (VAPS) SOLENOID ACTUATOR OUTPUT SHORT TO GROUND

⚠ CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step	Result / Action to Take
A1 ISOLATE THE VAPS SOLENOID	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Disconnect: VAPS Solenoid C120. • Measure the resistance across VAPS solenoid C120, pin-1 and pin-2, component side.  N0013095 • **Is the resistance approximately 6 to 8 ohms?**	**Yes** GO to A2 . **No** INSTALL a new VAPS solenoid. REFER to Section 211-02 . CLEAR the DTC. REPEAT the self-test.
A2 CHECK CIRCUIT 8-CE9 (WH/GN) FOR A SHORT TO GROUND	

• Disconnect: FEM C201a. • Measure the resistance between VAPS solenoid C120-2, circuit 8-CE9 (WH/GN), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** REFER to Section 419-10 to diagnose the FEM. **No** REPAIR circuit 8-CE9 (WH/GN). CLEAR the DTC. REPEAT the self-test.

Pinpoint Test B: DTC C1925 — VAPS Solenoid Actuator Return Circuit Failure

Refer to Wiring Diagrams Cell 43 , Power Steering Controls for schematic and connector information.

Normal Operation

The front electronic module (FEM) sends the variable assist power steering (VAPS) solenoid a pulse-width modulated (PWM) current through circuit 8-CE9 (WH/GN). The VAPS solenoid sends a feedback voltage to the FEM module, depending on the power steering assist demand, through circuit 9-CE9 (BN/GN).

- DTC C1925 VAPS Solenoid Actuator Return Circuit Failure — This DTC is set when the VAPS output current is different from the VAPS current read back from the solenoid. If the current being requested (output) is different from that read back for more than one second, the DTC is set.

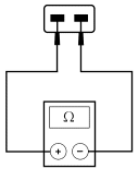
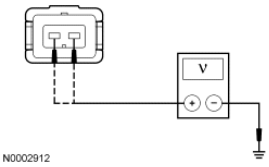
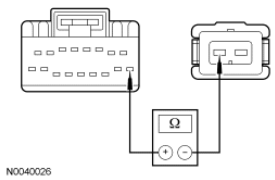
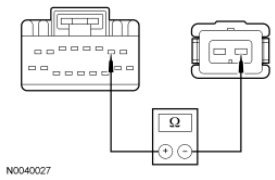
This pinpoint test is intended to diagnose the following:

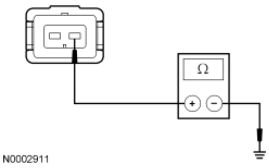
- Wiring, terminals or connectors
- Power steering valve solenoid
- VAPS solenoid
- FEM

PINPOINT TEST B: DTC C1925 — VAPS SOLENOID ACTUATOR RETURN CIRCUIT FAILURE

⚠ CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step	Result / Action to Take
B1 ISOLATE THE VAPS SOLENOID	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Disconnect: VAPS Solenoid C120. • Measure the resistance across the VAPS solenoid C120, pin-1 and pin-2, component side.	**Yes** GO to B2 . **No** INSTALL a new VAPS solenoid. REFER to Section 211-02 . CLEAR The DTC. REPEAT the self-test.

 N0013095 • **Is the resistance approximately 6 to 8 ohms?**	
B2 CHECK CIRCUITS 8-CE9 (WH/GN) AND 9-CE9 (BN/GN) FOR A SHORT TO VOLTAGE	
• Disconnect: FEM C201a. • Ignition ON. • Measure the voltage between ground and: ♦ VAPS solenoid C120-2, circuit 8-CE9 (WH/GN), harness side. ♦ VAPS solenoid C120-1, circuit 9-CE9 (BN/GN), harness side.  N0002912 • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTC. REPEAT the self-test. **No** GO to B3 .
B3 CHECK CIRCUIT 8-CE9 (WH/GN) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between VAPS solenoid C120-2, circuit 8-CE9 (WH/GN), harness side and FEM C201a-9, circuit 8-CE9 (WH/GN), harness side.  N0040026 • **Is the resistance less than 5 ohms?**	**Yes** GO to B4 . **No** REPAIR circuit 8-CE9 (WH/GN). CLEAR the DTC. REPEAT the self-test.
B4 CHECK CIRCUIT 9-CE9 (BN/GN) FOR AN OPEN	
• Measure the resistance between VAPS solenoid C120-1, circuit 9-CE9 (BN/GN), harness side and the FEM C201a-2, circuit 9-CE9 (BN/GN), harness side.  N0040027	**Yes** GO to B5 . **No** REPAIR circuit 9-CE9 (BN/GN). CLEAR the DTC. REPEAT the self-test.

• **Is the resistance less than 5 ohms?**	
B5 CHECK CIRCUIT 9-CE9 (BN/GN) FOR A SHORT TO GROUND	
• Measure the resistance between VAPS solenoid C120-1, circuit 9-CE9 (BN/GN), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** REFER to Section 419-10 to diagnose the FEM. **No** REPAIR circuit 9-CE9 (BN/GN). CLEAR the DTC. REPEAT the self-test.

Pinpoint Test C: Steering Has Lack of Assist or Inconsistent Assist

NOTE: Hard steering or lack of assist is experienced when the steering wheel effort exceeds specifications. Hard steering can remain constant through the full turn, occur near the end of a turn or differ right to left. It is important to know the difference between hard steering/lack of assist and poor returnability/sticky steering.

This pinpoint test is intended to diagnose the following:
- Steering gear
- Power steering pump
- Power steering hoses

PINPOINT TEST C: STEERING HAS LACK OF ASSIST OR INCONSISTENT ASSIST

Test Step	Result / Action to Take
C1 CHECK THE FRONT ELECTRONIC MODULE (FEM) FOR DTCs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger FEM. • Retrieve and record all FEM DTCs. • **Are any FEM DTCs present?**	**Yes** GO to the Front Electronic Module (FEM) DTC Chart in this section. **No** GO to C2 .
C2 CHECK THE STEERING ASSIST WITH THE ENGINE RPM RAISED	
• **⚠ CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.** • Set the engine at 2,100 rpm and turn the steering wheel fully to the left and right. • **Is steering assist normal with the engine rpm raised?**	**Yes** INSTALL a new power steering pump. REFER to Section 211-02 . **No** GO to C3 .

C3 CHECK FOR A CHANGE OF ASSIST ON LEFT AND RIGHT TURNS	
• With the engine at idle, turn the steering wheel fully to the left and to the right. • **Does the steering assist change when turning from right to left?**	**Yes** INSTALL a new steering gear. REFER to Section 211-02 . **No** GO to C4 .
C4 CHECK THE STEERING LINES AND HOSES FOR RESTRICTIONS	
• Inspect the steering lines and hoses for damage, kinks or restrictions. • **Are the steering lines or hoses damaged, kinked or restricted?**	**Yes** INSTALL new lines or hoses as necessary. REFER to Section 211-02 . **No** GO to C5 .
C5 MONITOR THE ENGINE RPM CHANGES	
⚠ **CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.** **NOTE:** Make sure that the vehicle is on a flat, dry surface, all accessories are in the OFF position and that the steering system is at normal operating temperature. • Connect the scan tool. • Start the engine. • With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times. • While monitoring the engine rpm with the scan tool, turn the steering wheel quickly to the left stop position and then to the right stop position. • Note the engine rpm during the turns. • **Does the engine rpm change (even temporarily) more than 30 rpm when turning the steering wheel?**	**Yes** INSTALL a new steering gear. REFER to Section 211-02 . **No** INSTALL a new power steering pump. REFER to Section 211-02 .

Pinpoint Test D: Excessive Steering Wheel Play

This pinpoint test is intended to diagnose the following:
- Steering linkage
- Steering column shaft
- Steering gear

PINPOINT TEST D: EXCESSIVE STEERING WHEEL PLAY

Test Step	Result / Action to Take

D1 CHECK THE STEERING LINKAGE	
• Carry out the Steering Linkage Component Test in this section. • **Is the steering linkage OK?**	**Yes** GO to D2 . **No** INSTALL new steering linkage components as necessary. REFER to Section 211-02 .
D2 CHECK THE STEERING COLUMN SHAFT	
• Inspect the steering column shaft U-joints and fasteners for looseness. • **Are the U-joints and fasteners OK?**	**Yes** INSTALL a new steering gear as necessary. REFER to Section 211-02 . **No** TIGHTEN the steering column shaft fasteners or INSTALL a new steering column shaft. REFER to Section 211-04 .

Pinpoint Test E: Steering System Drift/Pull/Wander

This pinpoint test is intended to diagnose the following:

- Steering gear
- Intermediate shaft
- Intermediate shaft U-joints
- Steering gear mounts
- Suspension components

PINPOINT TEST E: STEERING SYSTEM DRIFT/PULL/WANDER

Test Step	Result / Action to Take
E1 CHECK FOR TIRE PULL	
• Rotate the front wheels and tires side to side. Refer to Section 204-04 . • Carry out a road test on a smooth, flat road. • **Does the vehicle drift/pull?**	**Yes** If vehicle pulls in the opposite direction, GO to E2 . If vehicle pulls in the original direction, GO to E3 . **No** The concern has been corrected.
E2 ROTATE THE WHEELS AND TIRES FRONT TO REAR	
• Rotate the wheels and tires front to rear. Refer to Section 204-04 . • Carry out a road test on a smooth, flat road. • **Does the vehicle drift/pull?**	**Yes** GO to E3 . **No** The concern has been corrected.
E3 CHECK THE STEERING COLUMN SHAFT	

NOTE: Be sure to keep the clockspring centered when disconnecting the steering column shaft. Refer to the appropriate section in Group 501 for the procedure. • Check the steering column and shaft for grounding. • Disconnect the steering column shaft at the steering column. • Inspect the steering column shaft U-joints for looseness or wear. • **Are the steering column shaft U-joints OK?**	**Yes** GO to E4 . **No** INSTALL a new steering column shaft as necessary. REFER to Section 211-04 .
E4 CHECK THE STEERING GEAR MOUNTING	
• Check the steering gear mounts for looseness or wear. • **Are the steering gear mounts OK?**	**Yes** GO to E5 . **No** INSTALL a new steering gear as necessary. REFER to Section 211-02 .
E5 CHECK THE STEERING GEAR	
• Carry out the Steering Gear Valve Component Test in this section. • **Is the steering gear valve OK?**	**Yes** GO to E6 . **No** INSTALL a new steering gear as necessary. REFER to Section 211-02 .
E6 CHECK THE SUSPENSION COMPONENTS	
• Inspect the suspension components. Refer to Section 204-00 for the suspension diagnosis and testing. • **Are the suspension components OK?**	**Yes** GO to E7 . **No** INSTALL new suspension components as necessary. REFER to Section 204-01 for the front suspension or Section 204-02 for the rear suspension.
E7 CHECK THE WHEEL ALIGNMENT	
NOTE: The vehicle will tend to pull toward the side with the least positive caster and the most positive camber. • Using a suitable alignment system, measure the wheel alignment settings. Refer to Section 204-00 . • **Are the alignment settings within specifications?**	**Yes** CHECK for correct frame alignments. Refer to the appropriate section in Group 502 for the procedure. **No** ADJUST the alignment angles to specifications. DO NOT exceed the specifications. TEST the system for normal operation.

Component Tests

Power Steering Fluid Leak Test

NOTE: This test should only be carried out if a leak in the system has not been detected during a thorough visual inspection. Refer to Inspection and Verification.

1. Check the power steering fluid level. If necessary, add the specified power steering fluid.

2. Remove the power steering pump reservoir cap and tightly install the evacuation cap to the power steering pump reservoir.

3. Install the hose from the fill adapter manifold tee to the evacuation cap on the power steering pump reservoir.

4. Install the vacuum pump to the evacuation cap.

5. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.

6. Observe the vacuum gauge for 30 seconds. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg), a leak is present.

7. Remove the vacuum pump.

8. ⚠ **CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

   Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.

9. Visually inspect the system for leaks. If a leak is evident, repair as necessary. If a leak is not evident, add the specified UV fluorescent tracer dye to the power steering fluid. Use 14.78 ml (1/2 oz) of dye solution for every 1.89L (2 qt) of power steering fluid. For steering system fluid capacity, refer to Specifications in this section.

10. ⚠ **CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

    Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.

11. **NOTE:** On vehicles with rack and pinion steering gear, it may be necessary to remove the bellows boot clamp from the steering gear bellows boots to inspect for internal steering gear leaks.

    Using the special tool (UV lamp), inspect the system for traces of UV dye. Repair as necessary.

Steering Linkage

1. **NOTE:** Excessive vertical motion of the studs relative to the sockets may indicate excessive wear.

   With the vehicle on the ground and the parking brake applied, start the vehicle and carry out the following:

   - Have an assistant rotate the steering wheel back and forth 360 degrees and watch for relative motion of the studs in the steering linkage ball sockets.
   - Watch for loose steering gear mounting.

2. An additional check is with the key ON, engine OFF (KOEO) and the front wheels raised off the

ground, grasp the wheel at the front and rear and watch for excessive play or binding in the joints while trying to steer the wheels.

3. Install new components if necessary. Tighten any worn, damaged or loose components.

4. If equipped with fire suppression system, repower the system.

Steering Gear Valve

1. With the vehicle in motion, place the transmission in NEUTRAL and turn the engine OFF.
   - If the vehicle does not pull with the engine OFF, repair or install a new steering gear. Refer to Section 211-02 .

2. If the vehicle pulls with the engine OFF, switch the right side front wheel to the left side of the vehicle and the left side front wheel to the right side of the vehicle.

3. If the vehicle pulls to the opposite side, switch the front wheels with the rear wheels keeping them on the same side of the vehicle.

4. If the vehicle pull direction does not change, check the front suspension components, wheel alignment and frame alignment. Refer to Section 204-00 or an appropriate frame dimensions manual.

Steering Gear Grunt/Shudder Test

1. Start and run the vehicle to operating temperature.

2. Set engine idle speed to 1,200 rpm.

3. ⚠ **CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

   Rotate the steering wheel to the RH stop, then turn the steering wheel 90 degrees back from that position. Slowly turn the steering wheel back and forth approximately 1/12 of a full turn.

4. Turn the steering wheel another 90 degrees. Slowly turn the steering wheel back and forth approximately 1/12 of a full turn.

5. Repeat the test with the power steering fluid at different temperatures.

6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition.

7. If a loud grunt is heard, or a strong shudder is felt, purge the power steering system. Refer to Power Steering System Purging in this section. If a loud grunt or strong shudder still exists, check the power steering lines/hoses for restrictions or damage and repair as necessary. Refer to Section 211-02 . If the lines/hoses are OK, install a new steering gear. Refer to Section 211-02 .

Power Steering System Filling

Special Tool(s)

ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent
ST2670-A	Evacuation Cap, Power Steering 211-265 or equivalent
ST2626-A	Fill Adapter Manifold, Power Steering 211-327 or equivalent

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®

1. ⚠ **CAUTION: If the air is not purged from the power steering system correctly, premature power steering pump failure can result. The condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.**

   Remove the power steering pump reservoir cap.

2. Tightly install the evacuation cap to the power steering pump reservoir.

3. Install the hose from the fill adapter manifold tee to the evacuation cap on the power steering pump reservoir.

4. Install the vacuum pump to the fill adapter manifold control valve.

5. Install the hose to the opposite fill adapter manifold control valve and submerge the open end of the hose into a container of new power steering fluid.

6. **NOTE:** The fill adapter manifold control valves are in the open position when the point of the handles face the center of the fill adapter manifold.

   Close the fill adapter manifold control valve connected to the power steering fluid container.

7. Open the fill adapter manifold control valve connected to the vacuum pump.

8. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.

9. Observe the vacuum gauge for 30 seconds.

10. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg), correct any leaks in the power steering system or the filling tools before proceeding.

11. **NOTE:** The vacuum pump gauge reading will drop slightly during this step.

    Slowly open the fill adapter manifold control valve connected to the power steering fluid container until power steering fluid completely fills the hose.

12. Close the fill adapter manifold control valve connected to the power steering fluid container.

13. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.

14. Close the fill adapter manifold control valve connected to the vacuum pump.

15. Slowly open the fill adapter manifold control valve connected to the power steering fluid container.

16. When the power steering fluid has drained from the hose connected to the power steering fluid container, close the fill adapter manifold control valve connected to the power steering fluid container.

17. Remove the tools from the vehicle.

18. Install the power steering reservoir cap.

19. ⚠ **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

    NOTE: There will be a slight drop in the power steering fluid level in the power steering fluid reservoir when the engine is started.

    Start the engine and turn the steering wheel from stop-to-stop.

20. If equipped with Hydro-Boost®, apply the brake pedal twice.

21. Turn the ignition switch to the OFF position.

22. ⚠ **CAUTION: Do not overfill the reservoir.**

    Remove the power steering reservoir cap and fill the reservoir.

23. Install the power steering reservoir cap.

Power Steering System Flushing

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®

⚠ WARNING: Do not mix oil types. Any mixture or any unapproved oil can lead to seal deterioration and leaks. A leak can ultimately cause loss of fluid, which can result in a loss of power steering assist. Failure to follow these instructions may result in personal injury.

1. Remove the power steering fluid reservoir cap.
2. Using a suitable suction device, remove the power steering fluid from the reservoir.
3. Disconnect the power steering fluid return hose from the reservoir.
   - Remove the clamp.
4. Plug the power steering fluid reservoir inlet port.
5. Attach an extension hose to the power steering return hose.
6. **NOTE:** Do not reuse the power steering fluid that has been flushed from the power steering system.

   Place the open end of the extension hose into a suitable container.
7. **⚠ CAUTION: Do not overfill the reservoir.**

   Fill the power steering fluid reservoir with new fluid.
8. **⚠ CAUTION: Do not allow the power steering pump to run completely dry of power steering fluid.**

   Start the engine while simultaneously turning the steering wheel to lock and then immediately turn the ignition switch to the OFF position.
9. **⚠ CAUTION: Avoid turning the steering wheel without the engine running as this may cause air to be pulled into the steering gear.**

   ⚠ CAUTION: Do not overfill the reservoir.

   Fill the power steering fluid reservoir with the approved power steering fluid.
10. Repeat Steps 8 and 9, turning the steering wheel in the opposite direction each time, until the fluid exiting the power steering fluid return hose is clean and clear of foreign material.
11. Remove the extension hose from the power steering return hose.

12. Remove the plug from the power steering fluid reservoir inlet port.

13. Install the power steering return hose to the reservoir.
    - Install the clamp.

14. **NOTE:** It is necessary to correctly fill the power steering system to remove any trapped air and completely fill the power steering system components.

    If, after correctly filling the power steering system, there is power steering noise accompanied by evidence of aerated fluid and there are no fluid leaks, it may be necessary to purge the power steering system. For additional information, refer to Power Steering System Purging in this section.

    Fill the power steering system. For additional information, refer to Power Steering System Filling in this section.

Power Steering System Purging

Special Tool(s)

ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent
ST2670-A	Evacuation Cap, Power Steering 211-265 or equivalent

Material

Item	Specification
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®

⚠ **CAUTION: If the air is not purged from the power steering system correctly, premature power steering pump failure can result. The condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.**

1. **NOTE:** A whine heard from the power steering pump can be caused by air in the system. The power steering purge procedure must be carried out prior to any component repair for which power steering noise complaints are accompanied by evidence of aerated fluid.

   Remove the power steering pump reservoir cap. Check the fluid.

2. Raise the front wheels off the floor. Refer to the appropriate section in Group 100 for the procedure.

3. Tightly insert the stopper of the vacuum pump into the reservoir.

4. Start the engine.

5. Install the vacuum pump, apply vacuum and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).

6. If equipped with Hydro-Boost®, apply the brake pedal twice.

7. ⚠ **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

   Cycle the steering wheel fully from stop-to-stop 10 times.

8. Stop the engine.

9. Release the vacuum and remove the vacuum pump.

10. ⚠ **CAUTION: Do not overfill the reservoir.**

    Fill the reservoir.

    - Use approved transmission fluid.

11. Start the engine.
12. Install the vacuum pump. Apply and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).
13. ⚠ **CAUTION: Do not hold the steering wheel against the stops for more than 3 to 5 seconds at a time. Damage to the power steering pump can occur.**

    Cycle the steering wheel fully from stop-to-stop 10 times.

14. Stop the engine, release the vacuum and remove the vacuum pump.
15. ⚠ **CAUTION: Do not overfill the reservoir.**

    Fill the reservoir as needed and install the reservoir cap.

16. Visually inspect the power steering system for leaks.
17. ⚠ **CAUTION: Do not overfill the reservoir.**

    Fill the reservoir as needed and visually inspect the power steering system for leaks.

18. Install the reservoir cap.

General Specifications

Item	Specification
Lubricant	
Premium Long Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B

Torque Specifications

Description	Nm	lb-ft	lb-in
Power Steering System			
Air conditioning compressor bolts	25	18	—
Cooler-to-radiator bolts	10	—	89
Fluid cooler-to-radiator bolts	10	—	89
Inner tie rod	100	74	—
Intermediate shaft slider bolt	35	26	—
Intermediate shaft-to-steering gear bolt	35	26	—
Lower reservoir isolator bolt	10	—	89
Power steering line retainer bracket bolt	10	—	89
Pressure line fitting	33	24	—
Pump bolts (upper/lower)	25	18	—
Radiator hose tube-to-engine bolts	10	—	89
Steering line clamp plate bolt	10	—	89
Steering gear-to-crossmember nuts and bolts	90	66	—
Tie-rod end jam nut	55	41	—
Tie-rod end nut	80	59	—
Upper reservoir isolator bolt	4	—	35
Variable assist power steering (VAPS) actuator bolts	3	—	27

Power Steering

The power steering system consists of the following:

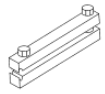
- Power steering pump
- Fluid reservoir
- Rack-and-pinion steering gear
- Fluid cooler
- Power steering pressure and return lines/hoses
- Variable assist power steering (VAPS) actuator

Power Steering

Refer to Section 211-00 .

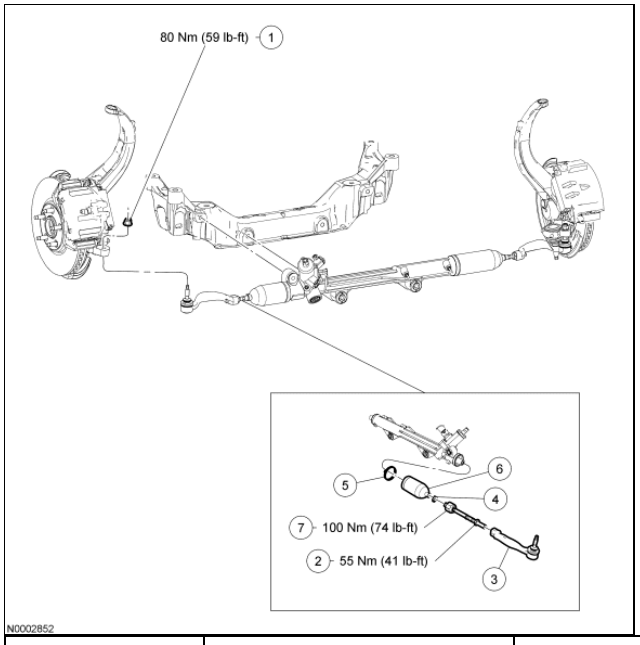
Inner Tie Rod

Special Tool(s)

ST1444-A	Installer Set, Teflon® Seal 211-D027 (D90P-3517-A) or equivalent
 ST1301-A	Installer, Constant Velocity Boot Clamp 205-343 (T95P-3514-A)

Material

Item	Specification
Premium Long Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B



Item	Part Number	Description
1	W520214	Tie-rod end nut
2	W709537	Tie-rod end jam nut
3	3A130	Tie-rod end
4	3C650	Outer bellows clamp
5	3C650	Inner bellows clamp
6	3K661	Steering gear bellows
7	3280	Inner tie rod

Removal

NOTICE: **The boots and clamps are designed to provide an airtight seal and protect the internal components of the steering gear. If the seal is not airtight the vacuum generated during turning draws water and contamination into the gear causing premature damage.**

NOTICE: **Zip ties do not produce an airtight seal and must not be used.**

NOTICE: **The inner ball joint grease is not compatible with water, and contamination trapped in the grease degrades the life of the joint.**

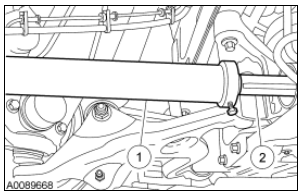
NOTICE: **If present, the orientation of the vent tube must be noted so the boots and vent tubes can be installed in the correct location.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the tie-rod end nut.
3. Loosen the tie-rod end jam nut.
4. **NOTE:** Count the number of turns required to remove the tie-rod end for reference during installation.

   Disconnect the tie-rod end from the wheel knuckle and remove the tie-rod end.
5. Remove the tie-rod end jam nut.
6. Remove the outer bellows clamp.
7. Remove and discard the inner bellows clamp.
8. Remove the steering gear bellows.
9. ***NOTICE:*** **Place the steering gear at the center position. Use a 15/16 inch crowfoot on the flat of the rack gear to resist rotation and to prevent damage during removal and installation of the inner tie rod.**

   NOTE: An assistant may be needed to aid in the removal of the RH inner tie rod.

   Using the (1) special tool, remove the (2) inner tie rod.



Installation

1. ***NOTICE:*** **Remove any abrasive material. This material is extremely harmful to the steering gear.**

   Using the special tool, install the inner tie rod.

   - Tighten to 100 Nm (74 lb-ft).

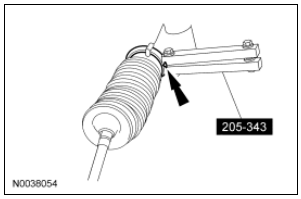
2. *NOTICE:* **Make sure the steering gear bellows is positioned between the 2 grooves on the inner tie rod or an internal leak can result.**

   NOTE: Lubricate the inner tie-rod groove with steering gear grease where the steering gear bellows is clamped.

   Install the steering gear bellows.

3. **NOTE:** Check that the steering gear bellows is not twisted and the vent tube (if equipped) is securely inserted into the vent nipple in the steering gear bellows.

   Using the special tool, install the inner bellows clamp.



4. Install the outer bellows clamp.

5. Thread the tie-rod end jam nut onto the inner tie rod.

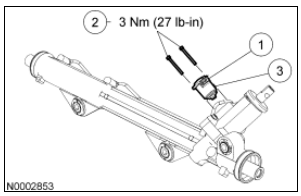
6. Install the tie-rod end the same number of turns noted during removal.

7. Connect the tie-rod end to the wheel knuckle and install the nut.
   - Tighten to 80 Nm (59 lb-ft).

8. Tighten the tie-rod end jam nut.
   - Tighten to 55 Nm (41 lb-ft).

9. Check and, if necessary, align the front wheels. For additional information, refer to Section 204-00 .

Power Steering Control Valve Actuator



Item	Part Number	Description
1	—	Variable assist power steering (VAPS) actuator electrical connector (part of 14401)
2	—	VAPS actuator bolts (2 required)
3	3N803	VAPS actuator

Removal and Installation

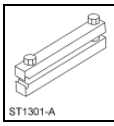
1. Disconnect the variable assist power steering (VAPS) actuator electrical connector.

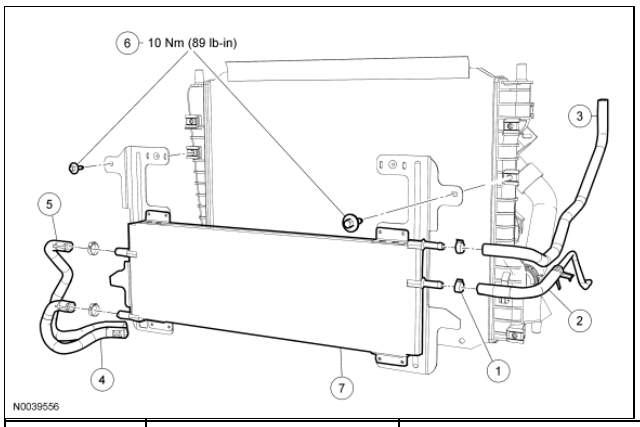
2. Remove the 2 bolts and the VAPS actuator.
   - To install, tighten to 3 Nm (27 lb-in).

3. To install, reverse the removal procedure.

Power Steering Fluid Cooler

Special Tool(s)

 ST1301-A	Installer, Constant Velocity Boot Clamp 205-343 (T95P-3514-A)



Item	Part Number	Description
1	3C750	Hose clamp (4 required)
2	3A713	Steering gear-to-cooler hose
3	3493	Cooler-to-reservoir return hose
4	7A030	Lower transmission cooler line
5	7A031A	Upper transmission cooler line
6	N811810	Cooler-to-radiator bolts (2 required)
7	3F749	Power steering fluid cooler

Removal and Installation

⚠ CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

1. Remove the air conditioning condenser. For additional information, refer to Section 412-01 .

2. Remove and discard the 4 hose clamps.

3. Remove the steering gear-to-cooler hose.
   - Allow the fluid to drain into a suitable container.

4. Remove the cooler-to-reservoir return hose.

5. Remove the lower transmission cooler line.
   - Allow the fluid to drain into a suitable container.

6. Remove the upper transmission cooler line.

7. Remove the 2 bolts and the power steering fluid cooler.

Installation

1. Install the power steering fluid cooler and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

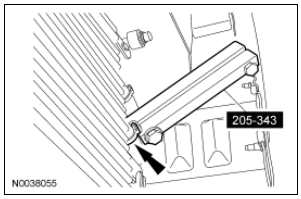
2. Install the hose clamp and the upper transmission cooler line.

3. Install the hose clamp and the lower transmission cooler line.

4. Install the hose clamp and the cooler-to-reservoir return hose.

5. Install the hose clamp and the steering gear-to-cooler hose.

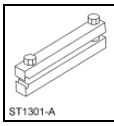
6. Using the special tool, tighten the 4 hose clamps.

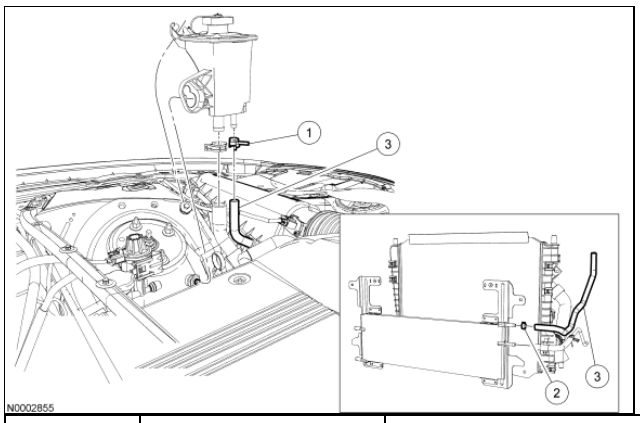


7. Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Fluid Cooler to Power Steering Fluid Reservoir Return Hose

Special Tool(s)

 ST1301-A	Installer, Constant Velocity Boot Clamp 205-343 (T95P-3514-A)



Item	Part Number	Description
1	—	Reservoir return hose clamp
2	3C750	Cooler-to-reservoir return hose clamp
3	3A713	Cooler-to-reservoir return hose

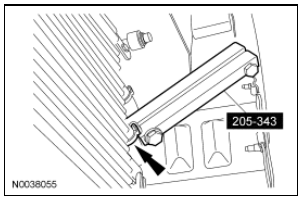
Removal

⚠ CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

1. Remove the air conditioning condenser. For additional information, refer to Section 412-01 .
2. Using a suitable suction device, drain the power steering fluid reservoir.
3. Remove the clamp and disconnect the cooler-to-reservoir return hose at the reservoir.
4. Remove the cooler-to-reservoir return hose clamp and the hose.

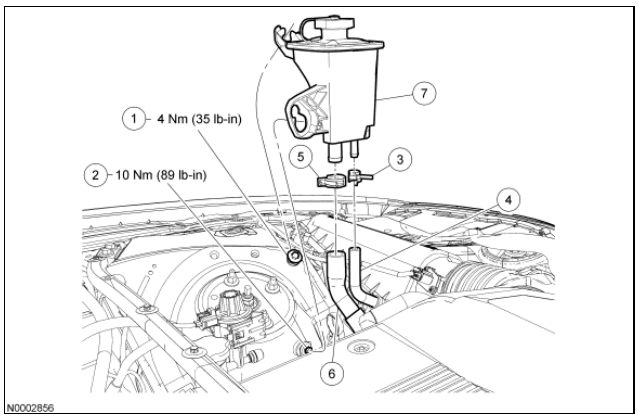
Installation

1. Install the cooler-to-reservoir return hose clamp and the hose.
2. Using the special tool, tighten the cooler-to-reservoir return hose clamp.



3. Connect the cooler-to-reservoir return hose at the reservoir and install the clamp.
4. Install the air conditioning condenser. For additional information, refer to Section 412-01 .
5. Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Fluid Reservoir



Item	Part Number	Description
1	N803882	Upper reservoir isolator bolt
2	W705012	Lower reservoir isolator bolt
3	3A713	Cooler-to-reservoir return hose clamp
4	3A713	Cooler-to-reservoir return hose
5	3691	Reservoir-to-pump supply hose clamp
6	3691	Reservoir-to-pump supply hose
7	3E764	Fluid reservoir

Removal and Installation

NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.**

1. Using a suitable suction device, drain the fluid reservoir.

2. Loosen the upper reservoir isolator bolt.
   - To install, tighten to 4 Nm (35 lb-in).

3. Loosen the lower reservoir isolator bolt.
   - To install, tighten to 10 Nm (89 lb-in).

4. Disconnect the cooler-to-reservoir return hose clamp and remove the hose.

5. Disconnect the reservoir-to-pump supply hose clamp and remove the hose.

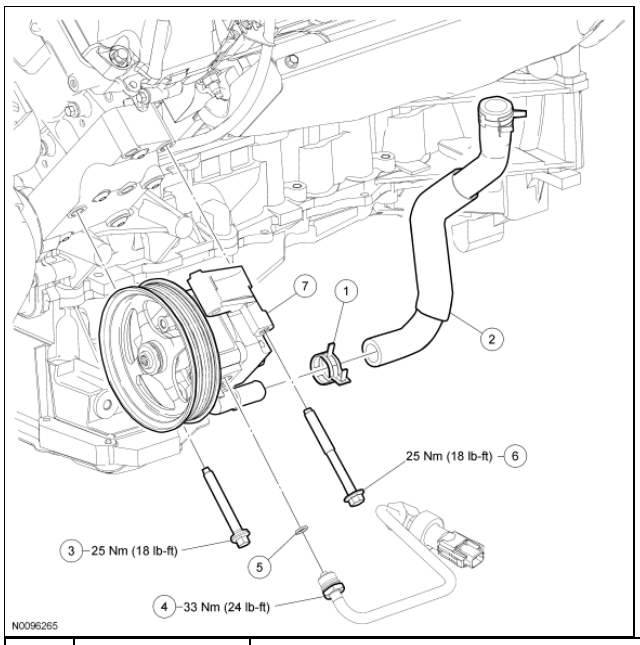
6. Lift the fluid reservoir upward off the isolators.

7. To install, reverse the removal procedure.
   - Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Pump

Special Tool(s)

ST1444-A	Installer Set, Teflon® Seal 211-D027 (D90P-3517-A) or equivalent



Item	Part Number	Description
1	—	Fluid reservoir-to-pump supply hose clamp (part of 3691)
2	3691	Fluid reservoir-to-pump supply hose
3	W705738	Lower pump bolt (2 required)
4	3A713	Pressure line fitting
5	3E764	Teflon® seal
6	W705416	Upper pump bolt (2 required)
7	3A696	Power steering pump

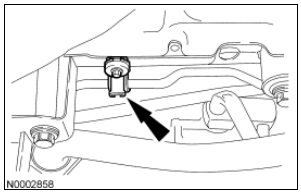
Removal and Installation

NOTICE: **Do not remove the power steering pulley from the power steering pump. The power steering pulley is not removable and damage to the pulley may occur.**

NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.**

1. Remove the A/C compressor. For additional information, refer to Section 412-01 .

2. Remove the power steering line retainer bracket bolt and position the bracket aside.



3. Disconnect the fluid reservoir-to-pump supply hose clamp and remove the hose.

4. Remove the 2 lower pump bolts.

5. Disconnect the pressure line fitting.

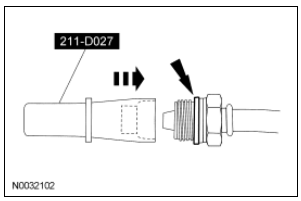
6. Remove and discard the Teflon® seal.

7. Remove the 2 upper pump bolts and the power steering pump.

Installation

1. Position the power steering pump and install the 2 upper pump bolts.
   - Tighten to 25 Nm (18 lb-ft).

2. Using the special tool, install a new Teflon® seal on the pressure line fitting.



3. Install the pressure line fitting.
   - Tighten to 33 Nm (24 lb-ft).

4. Install the 2 lower pump bolts.
   - Tighten to 25 Nm (18 lb-ft).

5. Install the fluid reservoir-to-pump supply hose and connect the clamp.

6. Install the power steering line retainer bracket and bolt.
   - Tighten to 10 Nm (89 lb-in).

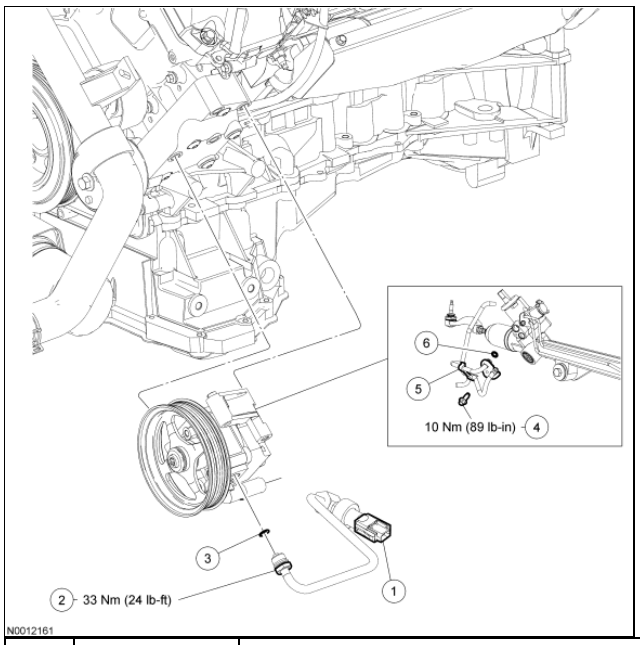
7. Install the A/C compressor. For additional information, refer to Section 412-01 .

8. Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Pump to Steering Gear Pressure Line

Special Tool(s)

ST1444-A	Installer Set, Teflon® Seal 211-D027 (D90P-3517-A) or equivalent



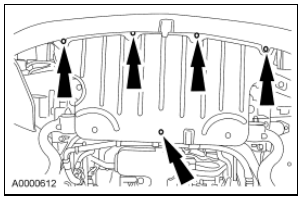
Item	Part Number	Description
1	—	Power steering pressure (PSP) switch electrical connector (part of 14401)
2	—	Pressure line fitting (part of 3A719)
3	3E764	Teflon® seal
4	W708113	Steering line clamp plate bolt
5	3A713	Pressure line
6	3F886	O-ring seal

Removal

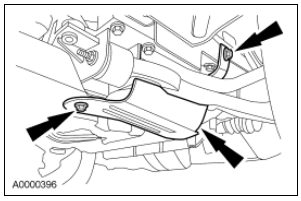
NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the 4 pin-type retainers, the screw and remove the air deflector.



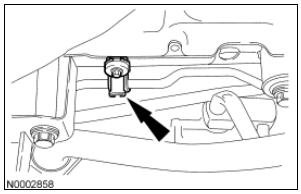
3. Remove the 3 pin-type retainers and the LH splash shield.



4. Disconnect the power steering pressure (PSP) switch electrical connector.

5. Disconnect the pressure line fitting and discard the Teflon® seal.
   - Allow the fluid to drain into a suitable container.

6. Remove the power steering line retainer bracket bolt.



7. Remove and discard the steering line clamp plate bolt.

8. Rotate the steering line clamp plate and remove the pressure line.
   - Discard the O-ring seal.

Installation

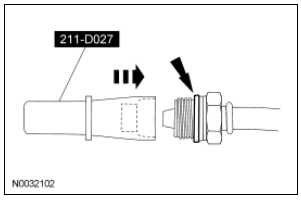
1. Install a new O-ring seal on the pressure line.

2. Install the pressure line to the steering gear and rotate the steering line clamp plate into position.

3. Install a new steering line clamp plate bolt.
   - Tighten to 10 Nm (89 lb-in).

4. Install the power steering line retainer bracket bolt.
   - Tighten to 10 Nm (89 lb-in).

5. Using the special tool, install a new Teflon® seal on the pressure line fitting.

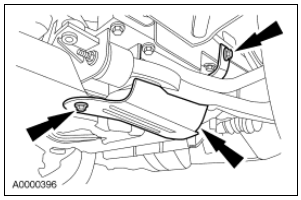


6. Install the pressure line fitting.

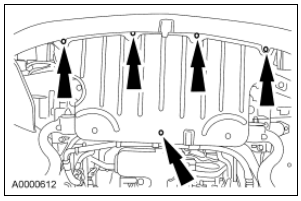
- Tighten to 33 Nm (24 lb-ft).

7. Connect the PSP switch electrical connector.

8. Install the LH splash shield and the 3 retainers.

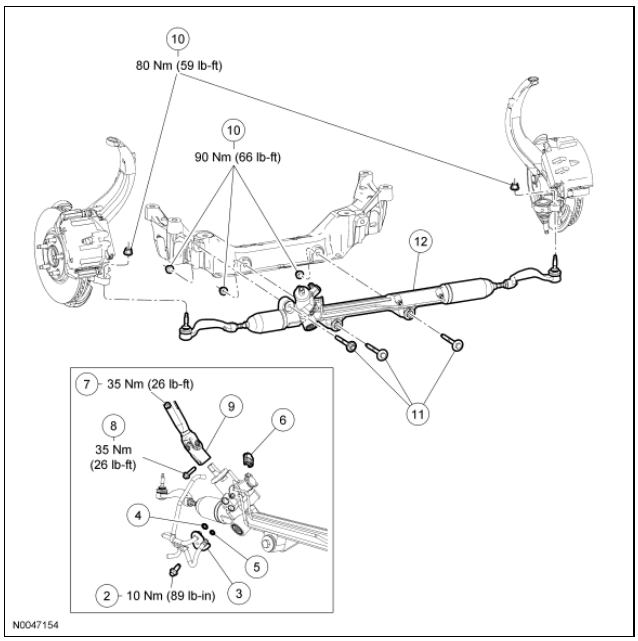


9. Install the air deflector, the 4 pin-type retainers and the screw.



10. Fill the power steering system. For additional information, refer to Section 211-00 .

Steering Gear



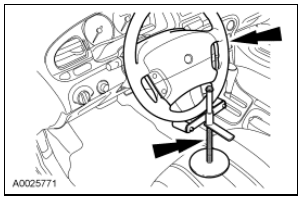
Item	Part Number	Description
1	W520214	Tie-rod end nuts (2 required)
2	W708113	Steering line clamp plate bolt
3	3A713	Steering line (pressure/return)
4	3F886	O-ring (pressure line)
5	N803257-S	O-ring (return line)
6	12B637	Variable assist power steering (VAPS) actuator electrical connector
7	—	Intermediate shaft slider bolt
8	W705113	Intermediate shaft-to-steering gear bolt
9	3B676	Intermediate shaft
10	W520214	Steering gear-to-crossmember nuts (3 required)
11	W708659	Steering gear-to-crossmember bolts (3 required)
12	3504	Steering gear

Removal and Installation

⚠ CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

1. **⚠ CAUTION: Do not allow the steering wheel to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   Hold the steering wheel in the straight-ahead position using a suitable holding device.



2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the 2 tie-rod end nuts and separate the 2 tie-rod ends from the wheel knuckles.
    - To install, tighten to 80 Nm (59 lb-ft).

4. Remove and discard the steering line clamp plate bolt and disconnect the steering lines from the steering gear.
    - To install, tighten to 10 Nm (89 lb-in).

5. Remove and discard the 2 O-ring seals.

6. Disconnect the variable assist power steering (VAPS) actuator electrical connector.

7. Loosen the intermediate shaft slider bolt.
    - To install, tighten to 35 Nm (26 lb-ft).

8. Remove and discard the intermediate shaft-to-steering gear bolt and disconnect the intermediate shaft from the steering gear.
    - To install, tighten to 35 Nm (26 lb-ft).

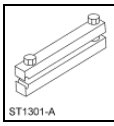
9. Remove the 3 steering gear-to-crossmember nuts and bolts.
    - To install, tighten to 90 Nm (66 lb-ft).

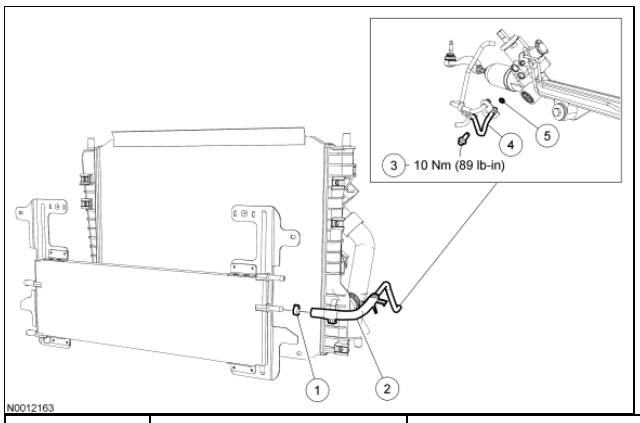
10. Remove the steering gear.

11. To install, reverse the removal procedure.
    - Fill the power steering system. For additional information, refer to Section 211-00 .

Steering Gear to Fluid Cooler Return Hose

Special Tool(s)

 ST1301-A	Installer, Constant Velocity Boot Clamp 205-343 (T95P-3514-A)



Item	Part Number	Description
1	3C750	Steering gear-to-cooler hose clamp
2	3A713	Steering gear-to-cooler hose
3	W708113	Steering line clamp plate bolt
4	3A713	Steering gear-to-cooler line
5	N803257	O-ring seal

Removal

⚠ CAUTION: While repairing the power steering system, care should be taken to prevent the entry of contaminants or premature failure of the power steering components can result.

1. Remove the air conditioning condenser. For additional information, refer to Section 412-01 .
2. Remove and discard the steering gear-to-cooler hose clamp.
3. Remove the steering gear-to-cooler hose.
   - Allow the fluid to drain into a suitable container.
4. Remove and discard the steering line clamp plate bolt.
5. Rotate the steering line clamp plate and remove the steering gear-to-cooler line.
6. Remove and discard the O-ring seal.

Installation

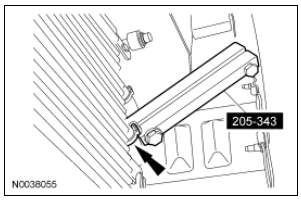
1. Install a new O-ring seal on the steering gear-to-cooler line.

2. Position the steering gear-to-cooler line to the steering gear.

3. Rotate the steering line clamp plate into position and install a new bolt.
   - Tighten to 10 Nm (89 lb-in).

4. Install a new steering gear-to-cooler hose clamp and connect the hose.

5. Using the special tool, tighten the steering gear-to-cooler hose clamp.



6. Fill the power steering system. For additional information, refer to Section 211-00 .

Torque Specifications

Description	Nm	lb-ft	lb-in
Column release motor screws	4	—	35
Horn switch pad bolts	6	—	53
Intermediate shaft bearing plate nuts	9	—	80
Intermediate shaft slider bolt	35	26	—
Intermediate shaft-to-steering gear bolt	35	26	—
Rotation sensor screws	1	—	9
Steering column-to-instrument panel nuts	30	22	—
Steering column-to-intermediate shaft bolt	30	22	—
Steering wheel bolt	38	28	—

Steering Column

Refer to Wiring Diagrams Cell 128 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Multimeter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Steering column	• Battery junction box (BJB) fuse 19 (15A) • Tilt/telescope switch • Circuitry • Electrical connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the concern remains after the inspection, connect diagnostic tool to the data link connector (DLC) located beneath the instrument panel to carry out diagnostic tool data link test. Refer to Section 418-00 . If the self-test is passed for the instrument cluster, retrieve the continuous diagnostic trouble codes (DTCs).
5. If DTCs are retrieved, go to the Instrument Cluster Diagnostic Trouble Code (DTC) Index to continue diagnostics.
6. If the self-test is passed and no DTCs are retrieved, GO to Symptom Chart .

7. If the instrument cluster cannot be accessed by the diagnostic tool, refer to the instrument cluster diagnostics for further instructions. Refer to Section 413-01 .

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	Instrument Cluster	CLEAR the DTC. REPEAT the self-test. If other DTCs are retrieved, repair those and REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new instrument cluster. REFER to Section 413-01 .
B2328	Steering Column Reach (Telescopic) Feedback Potentiometer Circuit Failure	Instrument Cluster	GO to Pinpoint Test A .
B2332	Steering Column Tilt Feedback Potentiometer Circuit Failure	Instrument Cluster	GO to Pinpoint Test B .
B2351	Tilt and Telescopic Adjustments are Inoperative	Instrument Cluster	GO to Pinpoint Test C .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: DTC B2328: Steering Column Reach (Telescopic) Feedback Potentiometer Circuit Failure

Normal Operation

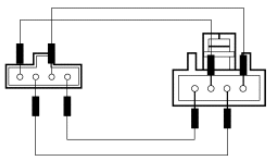
The steering column telescopic motor receives information from the steering column position sensor when a memory position is requested. The steering column position sensor sends the telescopic motor position information to the instrument cluster where it is stored and is used when several adjustable features are requested. The steering column position sensor sends the steering column telescopic position to the instrument cluster through circuit 8-AL16 (WH/BK).

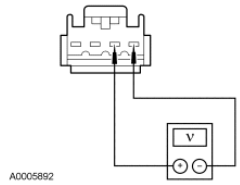
Possible Causes

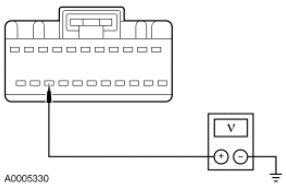
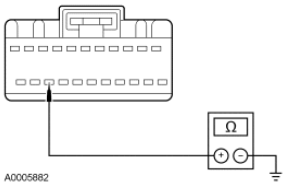
- Circuit shorted
- Circuit open
- Steering column position sensor
- Steering column mechanical component
- Instrument cluster

PINPOINT TEST A: DTC B2328 — STEERING COLUMN REACH (TELESCOPIC) FEEDBACK POTENTIOMETER CIRCUIT FAILURE

⚠ CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step	Result / Action to Take
A1 CHECK FOR CONTINUOUS DIAGNOSTIC TROUBLE CODES (DTCs)	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster Continuous DTCs. • **Is DTC B2328 present?**	**Yes** GO to A7 . **No** GO to A2 .
A2 CHECK FOR MECHANICAL FAULTS	
• Disconnect and reconnect the battery. • Enter the following diagnostic mode on the scan tool: Clear Instrument Cluster DTCs. • Actuate the steering column to the full IN position. • Actuate the steering column to the full OUT position. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Self-Test. • **Is DTC B2328 present?**	**Yes** GO to A3 . **No** The system was deactivated due to the instrument cluster registering an excessive number of motion faults. NOTIFY the owner that the concern has been corrected.
A3 CHECK THE STEERING COLUMN BEARINGS	
• Remove the steering column shrouds. • Make sure the steering column bearings are fully seated back against the stops. • **Are the steering column bearings correctly seated back against the stops?**	**Yes** GO to A4 . **No** INSTALL a new steering column. REFER to Steering Column in this section. CLEAR the DTCs. REPEAT the self-test.
A4 ISOLATE THE STEERING COLUMN POSITION SENSOR	
• Disconnect: Steering Column Position Sensor C222. • Connect a jumper wire between steering column position sensor C222-4, circuit 9-AL17 (BN/WH), harness side and steering column position sensor terminal 1.  AG0154-A • Connect a jumper wire between steering column position sensor C222-2, circuit 7-AL17 (YE/VT), harness side and steering column position sensor terminal 4. • Connect a jumper wire between steering column position	**Yes** INSTALL a new steering column. REFER to Steering Column in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to A5 .

sensor C222-3, circuit 8-AL17 (WH/VT) and steering column position sensor terminal 3. • Connect a jumper wire between steering column position sensor C222-1, circuit 8-AL16 (WH/BK) and steering column position sensor terminal 2. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Self-Test. • **Is DTC B2328 retrieved?**	
A5 CHECK FOR STEERING COLUMN MOVEMENT	
NOTE: This active command will only power the motors for one second. • Enter the following diagnostic mode on the scan tool: Tilt Motor UP Command. • Enter the following diagnostic mode on the scan tool: Tilt Motor DOWN Command. • **Does the steering column tilt up and down?**	**Yes** GO to A7 . **No** GO to A6 .
A6 ISOLATE THE TILT/TELESCOPE MOTOR	
• Disconnect: Tilt/Telescope Motor C227. • Connect a voltmeter between tilt/telescope motor C227-3, circuit 35-AL7 (VT/BK), harness side and tilt/telescope motor C227-4, circuit 34-AL7 (BU/BK), harness side.  • Enter the following diagnostic mode on the scan tool: Telescope Motor IN Command. • Enter the following diagnostic mode on the scan tool: Telescope Motor OUT Command. • Measure the voltage while triggering the active commands. • **Is voltage present for one second after each command is sent?**	**Yes** INSTALL a new telescope motor. REFER to Steering Column in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to A7 .
A7 CHECK CIRCUIT 8-AL17 (WH/VT) FOR A SHORT TO VOLTAGE	
• Disconnect: Instrument Cluster C220c. • Measure the voltage at instrument cluster C220c-20, circuit 8-AL17 (WH/VT), harness side.	**Yes** REPAIR circuit 8-AL17 (WH/VT) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. **No** GO to A8 .

 A0005330 • **Is voltage present?**	
A8 CHECK CIRCUIT 8-AL17 (WH/VT) FOR A SHORT TO GROUND	
• Measure the resistance between instrument cluster C220c-20, circuit 8-AL17 (WH/VT), harness side and ground.  A0005882 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A9 . **No** REPAIR circuit 8-AL17 (WH/VT) for a short to ground. CLEAR the DTCs. REPEAT the self-test.
A9 CHECK CIRCUIT 8-AL17 (WH/VT) FOR AN OPEN	
• Measure the resistance between instrument cluster C220c-20, circuit 8-AL17 (WH/VT), harness side and steering column position sensor C222-3, circuit 8-AL17 (WH/VT), harness side. • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: DTC B2332: Steering Column Tilt Feedback Potentiometer Circuit Failure

Normal Operation

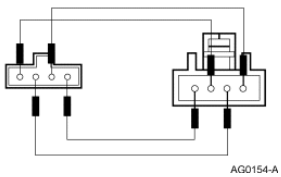
The steering column tilt motor receives information from the steering column position sensor when a memory position is requested. The steering column position sensor sends the tilt motor position information to the instrument cluster where it is stored and is used when several adjustable features are requested. The steering column position sensor sends the steering column tilt position to the instrument cluster through circuit 8-AL17 (WH/VT), and circuit 33-AL6 (YE/BU) powers the tilt motor.

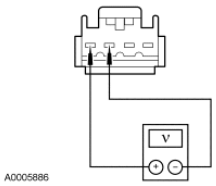
Possible Causes

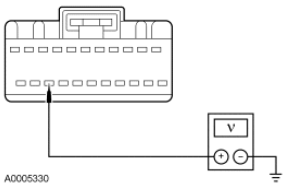
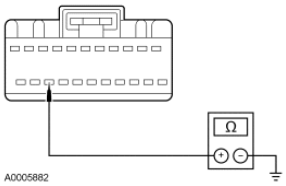
- Circuit shorted
- Circuit open
- Steering column position sensor
- Steering column mechanical component
- Instrument cluster

PINPOINT TEST B: DTC B2332 — STEERING COLUMN TILT FEEDBACK POTENTIOMETER CIRCUIT FAILURE

⚠ CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step	Result / Action to Take
B1 CHECK FOR CONTINUOUS DIAGNOSTIC TROUBLE CODES (DTCs)	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster Continuous DTCs . • **Is DTC B2332 present?**	**Yes** GO to B7 . **No** GO to B2 .
B2 CHECK FOR MECHANICAL FAULTS	
• Disconnect and reconnect the battery. • Enter the following diagnostic mode on the scan tool: Clear Instrument Cluster DTCs. • Actuate the steering column to the full IN position. • Actuate the steering column to the full OUT position. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Self-Test. • **Is DTC B2332 present?**	**Yes** GO to B3 . **No** The system was deactivated due to the instrument cluster registering an excessive number of motion faults. NOTIFY the owner that concern has been corrected.
B3 CHECK THE STEERING COLUMN BEARINGS	
• Remove the steering column shrouds. • Make sure the steering column bearings are fully seated back against the stops. • **Are the steering column bearings correctly seated back against the stops?**	**Yes** GO to B4 . **No** INSTALL a new steering column. REFER to Steering Column in this section. CLEAR the DTCs. REPEAT the self-test.
B4 ISOLATE THE STEERING COLUMN POSITION SENSOR	
• Disconnect: Steering Column Position Sensor C222. • Connect a jumper wire between steering column position sensor C222-4, circuit 9-AL17 (BN/WH), harness side and steering column position sensor terminal 1.  AG0154-A • Connect a jumper wire between steering column position sensor C222-2, circuit 7-AL17 (YE/VT), harness side and steering column position sensor terminal 4. • Connect a jumper wire between steering column position sensor C222-3, circuit 8-AL17 (WH/VT) and steering	**Yes** INSTALL a new steering column. REFER to Steering Column in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to B5 .

column position sensor terminal 3. • Connect a jumper wire between steering column position sensor C222-1, circuit 8-AL16 (WH/BK) and steering column position sensor terminal 2. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Self-Test. • **Is DTC B2332 retrieved?**	
B5 CHECK FOR STEERING COLUMN MOVEMENT	
NOTE: This active command will power the motors for only one second. • Enter the following diagnostic mode on the scan tool: Tilt Motor UP Command. • Enter the following diagnostic mode on the scan tool: Tilt Motor DOWN Command. • **Does the steering column tilt up and down?**	**Yes** INSTALL a new steering column. REFER to Steering Column in this section. Clear the DTC. REPEAT the self-test. **No** GO to B6 .
B6 ISOLATE THE TILT/TELESCOPE MOTOR	
• Disconnect: Tilt/Telescope Motor C227. • Connect a voltmeter between tilt/telescope motor C227-2, circuit 32-AL6 (WH/BU), harness side and tilt/telescope motor C227-1, circuit 33-AL6 (YE/BU), harness side.  • Enter the following diagnostic mode on the scan tool: Tilt Motor UP Command. • Enter the following diagnostic mode on the scan tool: Tilt Motor DOWN Command. • Measure the voltage while triggering the active commands. • **Is voltage present for one second after each command is sent?**	**Yes** INSTALL a new tilt motor. REFER to Steering Column in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to B7 .
B7 CHECK CIRCUIT 8-AL17 (WH/VT) FOR A SHORT TO VOLTAGE	
• Disconnect: Instrument Cluster C220c. • Measure the voltage at instrument cluster C220c-20, circuit 8-AL17 (WH/VT), harness side and ground.	**Yes** REPAIR circuit 8-AL17 (WH/VT) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. **No** GO to B8 .

 A0005330 • **Is voltage present?**	
B8 CHECK CIRCUIT 8-AL17 (WH/VT) FOR A SHORT TO GROUND	
• Measure the resistance between instrument cluster C220c-20, circuit 8-AL17 (WH/VT), harness side and ground.  A0005882 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B9 . **No** REPAIR circuit 8-AL17 (WH/VT) for a short to ground. CLEAR the DTCs. REPEAT the self-test.
B9 CHECK CIRCUIT 8-AL17 (WH/VT) FOR AN OPEN	
• Measure the resistance between instrument cluster C220c-20, circuit 8-AL17 (WH/VT), harness side and steering column position sensor C222-3, circuit 8-AL17 (WH/VT), harness side. • **Is the resistance less than 5 ohms?**	**Yes** GO to B10 . **No** REPAIR circuit 8-AL17 (WH/VT) for an open. CLEAR the DTCs. REPEAT the self-test.
B10 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The Tilt And Telescopic Adjustments Are Inoperative

Normal Operation

The tilt/telescope switch is hardwired to the instrument cluster. Depending on the direction of the switch (UP/DOWN/IN/OUT), a signal is sent to the instrument cluster to activate the tilt or telescope motor. The steering column telescopic motor receives information from the steering column position sensor when a memory position is requested. The steering column position sensor sends the telescopic motor position

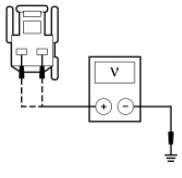
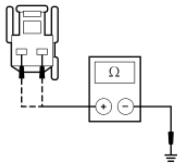
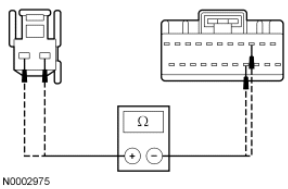
information to the instrument cluster where it is stored and is used when several adjustable features are requested. The steering column position sensor sends the steering column telescopic position to the instrument cluster through circuit 8-AL16 (WH/BK).

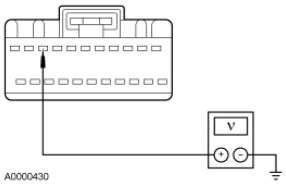
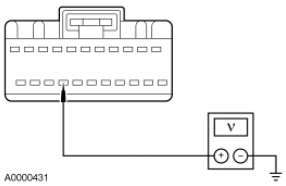
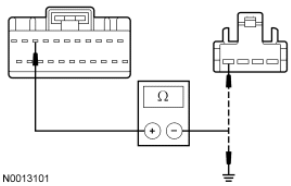
Possible Causes

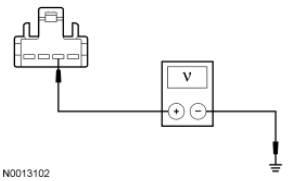
- Circuit shorted
- Circuit open
- Steering column
- Instrument cluster
- Tilt/telescope switch

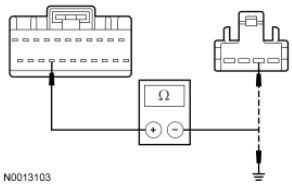
PINPOINT TEST C: THE TILT AND TELESCOPE ADJUSTMENT ARE INOPERATIVE

Test Step	Result / Action to Take
C1 CHECK CONTINUOUS DTCs	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster Continuous DTCs. • **Are DTCs B2328 or B2332 present?**	**Yes** If DTC B2328 was retrieved, GO to Pinpoint Test A . If DTC B2332 was retrieved, GO to Pinpoint Test B . **No** GO to C2 .
C2 CHECK THE INSTRUMENT CLUSTER PIDs	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster Tilt PID and Telescope PID. • Actuate the tilt/telescope switch to the tilt UP, tilt DOWN, telescope IN, telescope OUT and NEUTRAL positions. • **Do the PIDS correspond correctly with all the switch positions?**	**Yes** If DTC B2351 was previously retrieved, CLEAR the DTCs. REPEAT the self-test. If DTC B2351 is retrieved again, GO to C13 . If no DTCs were previously retrieved, GO to C7 . **No** GO to C3 .
C3 CHECK THE TILT/TELESCOPE SWITCH FOR CORRECT OPERATION	
• Ignition OFF. • Disconnect: Tilt/Telescope Switch C2250. • Carry out the tilt/telescope switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the tilt/telescope switch OK?**	**Yes** GO to C4 . **No** INSTALL a new tilt/telescope switch. REFER to Section 211-05 . REPEAT the self-test. CLEAR the DTCs.
C4 CHECK CIRCUITS 8-AL10 (WH) AND 9-AL10 (BN) FOR A SHORT TO VOLTAGE	

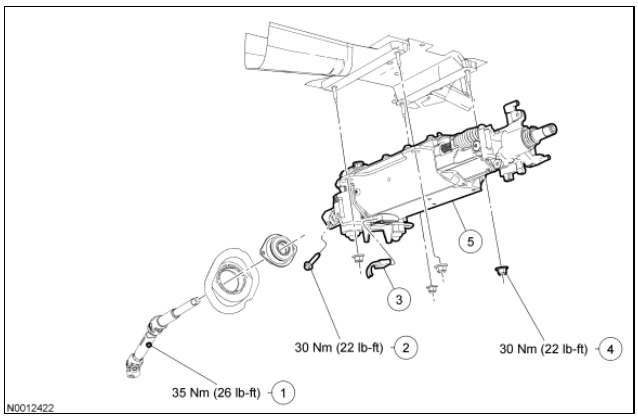
• Disconnect: Instrument Cluster C220c. • Ignition ON. • Measure the voltage between tilt/telescope switch C2250-1, circuit 9-AL10 (BN), harness side and ground; and between tilt/telescope switch C2250-2, circuit 8-AL10 (WH), harness side and ground.  N0002973 • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. **No** GO to C5 .
C5 CHECK CIRCUITS 8-AL10 (WH) AND 9-AL10 (BN) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between tilt/telescope switch C2250-1, circuit 9-AL10 (BN), harness side and ground; and between tilt/telescope switch C2250-2, circuit 8-AL10 (WH), harness side and ground.  N0002974 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to C6 . **No** REPAIR the affected circuit(s) for a short to ground. CLEAR the DTCs. REPEAT the self-test.
C6 CHECK CIRCUITS 8-AL10 (WH) AND 9-AL10 (BN) FOR AN OPEN	
• Measure the resistance between tilt/telescope switch C2250-1, circuit 9-AL10 (BN), harness side and instrument cluster C220c-3 circuit 9-AL10 (BN), harness side; and between tilt/telescope switch C2250-2, circuit 8-AL10 (WH), harness side and instrument cluster C220c-15 circuit 8-AL10 (WH), harness side.  N0002975 • **Are the resistances less than 5 ohms?**	**Yes** GO to C7 . **No** REPAIR the affected circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test.
C7 CHECK CIRCUIT 9-AL17 (BN/WH) FOR A SHORT TO VOLTAGE	

• Ignition ON. • Measure the voltage between instrument cluster C220c-9, circuit 9-AL17 (BN/WH), harness side and ground.  • **Is voltage present?**	**Yes** GO to C8 . **No** GO to C9 .
C8 CHECK CIRCUIT 7-AL17 (YE/VT) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Steering Column Position Sensor C222. • Ignition ON. • Measure the voltage between instrument cluster C220c-19, circuit 7-AL17 (YE/VT), harness side and ground.  • **Is voltage present?**	**Yes** REPAIR circuit 7-AL17 (YE/VT) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 9-AL17 (BN/WH) for a short to voltage. CLEAR the DTCs. REPEAT the self-test.
C9 CHECK CIRCUIT 9-AL17 (BN/WH) FOR A SHORT TO GROUND OR AN OPEN	
• Ignition OFF. • Disconnect: Steering Column Position Sensor C222. • Measure the resistance between instrument cluster C220c-9, circuit 9-AL17 (BN/WH), harness side and steering column position sensor C222-4, circuit 9-AL17 (BN/WH), harness side; and between instrument cluster C220c-9, circuit 9-AL17 (BN/WH), harness side and ground.  • **Are the resistances less than 5 ohms between the instrument cluster and the steering column position sensor and greater than 10,000 ohms between the instrument cluster and ground?**	**Yes** GO to C10 . **No** REPAIR circuit 9-AL17 (BN/WH) for a short to ground or an open. CLEAR the DTCs. REPEAT the self-test.

C10 CHECK FOR MOTOR MOTION SENSED	
• Connect: Instrument Cluster C220c. • Connect: Steering Column Position Sensor C222. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Steering Column Control Active Command. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Telescope Position PID and Tilt Position PID. • **NOTE:** This active command will only power the motors for one second. • Trigger tilt UP, tilt DOWN, telescope IN and telescope OUT on, one at a time while monitoring the telescope position PID and the tilt position PID. • **Do the telescope position and tilt position PIDs read SENSED when the corresponding motors are triggered on?**	**Yes** INSPECT the steering column position sensor and the instrument cluster connectors for loose or intermittent connections. CLEAR the DTCs. REPEAT the self-test. **No** GO to C11 .
C11 ISOLATE THE STEERING COLUMN POSITION SENSOR	
• Connect: Instrument Cluster C220c. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Steering Column Control Active Command. • Enter the following diagnostic mode on the scan tool: Trigger Telescope IN on. • Measure the voltage between steering column position sensor C222-2, circuit 7-AL17 (YE/VT), harness side and ground during the active command.  N0013102 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new steering column position sensor. CLEAR the DTCs. REPEAT the self-test. **No** GO to C12 .
C12 CHECK CIRCUIT 7-AL17 (YE/VT) FOR A SHORT TO GROUND OR AN OPEN	
• Ignition OFF. • Disconnect: Instrument Cluster C220c. • Measure the resistance between instrument cluster C220c-19, circuit 7-AL17 (YE/VT), harness side and steering column position sensor C222-2, circuit 7-AL17 (YE/VT), harness side; and between instrument cluster C220c-19, circuit 7-AL17 (YE/VT), harness side and ground.	**Yes** GO to C13 . **No** REPAIR circuit 7-AL17 (YE/VT) for a short to ground or an open. CLEAR the DTCs. REPEAT the self-test.

 N0013103 • **Are the resistances greater than 10,000 ohms between the instrument cluster and ground and less than 5 ohms between the instrument cluster and the steering column position sensor?**	
C13 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Steering Column



Item	Part Number	Description
1	3B676	Intermediate shaft slider bolt
2	W705113-S436	Steering column-to-intermediate shaft bolt
3	—	Electrical connector (part of 14401)
4	N806423-S424	Steering column-to-instrument panel nut (4 required)
5	3C529	Steering column

Removal and Installation

⚠ CAUTION: Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .

1. Depower the supplemental restraint system (SRS). For additional information, refer to Section 501-20B .

2. Remove the steering column opening reinforcement panel and the reinforcement. For additional information, refer to Section 501-12 .

3. Remove the multi-function switch. For additional information, refer to Section 211-05 .

4. Remove the steering wheel. For additional information, refer to Steering Wheel in this section.

5. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

6. Remove the intermediate shaft slider bolt.
   - To install, tighten to 35 Nm (26 lb-ft).

7. **NOTE:** Install a new steering column-to-intermediate shaft bolt.

   Remove and discard the steering column-to-intermediate shaft bolt.

   - To install, tighten to 30 Nm (22 lb-ft).

8. Disconnect the electrical connector.

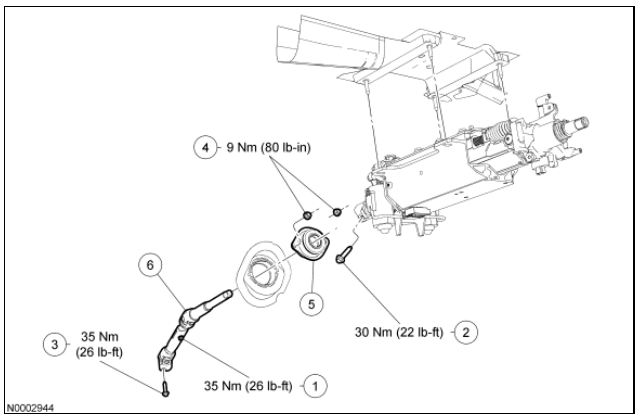
9. **NOTE:** Install 4 new steering column-to-instrument panel nuts.

   Remove and discard the 4 steering column-to-instrument panel nuts and the steering column.

   - To install, tighten to 30 Nm (22 lb-ft).

10. To install, reverse the removal procedure.
    - Repower the supplemental restraint system (SRS). For additional information, Refer to Section 501-20B .

Steering Column Shaft



Item	Part Number	Description
1	3B676	Intermediate shaft slider bolt
2	W705113-S436	Steering column-to-intermediate shaft bolt
3	W705113-S436	Intermediate shaft-to-steering gear bolt
4	N806385-S58	Intermediate shaft bearing plate nuts (2 required)
5	3E735	Intermediate shaft bearing plate
6	3C662	Intermediate shaft

Removal and Installation

⚠ CAUTION: Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .

1. Depower the supplemental restraint system (SRS). For additional information, refer to Section 501-20B .

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the intermediate shaft slider bolt.
   - To install, tighten to 35 Nm (26 lb-ft).

4. **NOTE:** Install a new steering column-to-intermediate shaft bolt.

   Remove and discard the steering column-to-intermediate shaft bolt.

   - To install, tighten to 30 Nm (22 lb-ft).

5. **NOTE:** Install a new intermediate shaft-to-steering gear bolt.

   Remove and discard the intermediate shaft-to-steering gear bolt.

   - To install, tighten to 35 Nm (26 lb-ft).

6. **NOTE:** Install 2 new intermediate shaft bearing plate nuts.

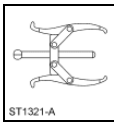
Remove and discard the 2 intermediate shaft bearing plate nuts and the plate.

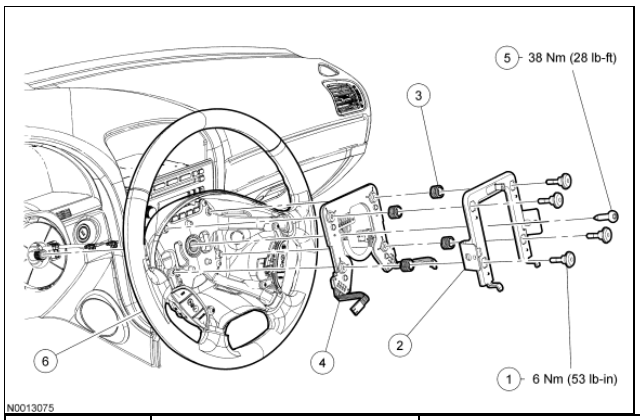
- To install, tighten to 9 Nm (80 lb-in).

7. Remove the intermediate shaft.
8. To install, reverse the removal procedure.

Steering Wheel

Special Tool(s)

 ST1321-A	Remover, Differential Bearing 205-116 (T77F-4220-B1)



Item	Part Number	Description
1	13A875	Horn switch pad bolt (4 required)
2	13A875	Horn switch pad
3	13A875	Horn switch spring (4 required)
4	13A875	Horn switch
5	N807493-S301	Steering wheel bolt
6	3600	Steering wheel

Removal and Installation

1. Remove the driver air bag module. For additional information, refer to Section 501-20B .

2. **NOTE:** When installing the horn switch springs, to provide correct tension between the horn pad and the horn switch, install the yellow horn switch springs at the bottom of the horn switch pad and the silver springs at the top.

   Remove the 4 horn switch pad bolts, horn switch pad and horn switch springs.

   - To install, tighten to 6 Nm (53 lb-in).

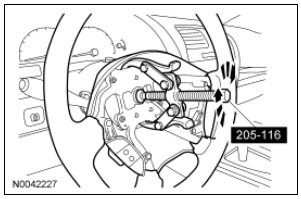
3. Remove the horn switch.

4. **NOTE:** Do not remove the steering wheel bolt until the steering wheel has been separated from the column.

   Loosen the steering wheel bolt.

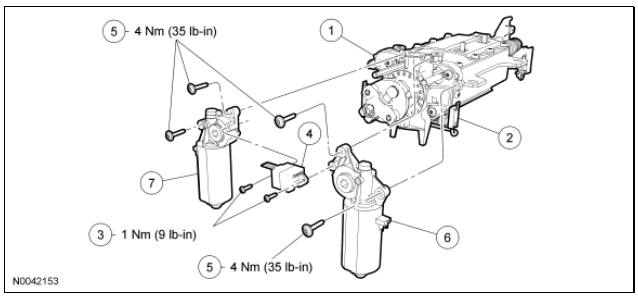
   - To install, tighten to 38 Nm (28 lb-ft).

5. Using the special tool, separate the steering wheel from the steering column shaft.
    - Remove and discard the steering wheel bolt.
    - Remove the steering wheel.



6. To install, reverse the removal procedure.
    - Install the driver air bag module. For additional information, refer to Section 501-20B .

Tilt/Telescopic Motors



Item	Part Number	Description
1	3C529	Steering column
2	3C529	Release motor electrical connector
3	390345-S36	Rotation sensor screws (2 required)
4	3F818	Rotation sensor
5	W701912-S436	Column release motor screws (4 required)
6	3D538H	Column release motor (telescopic)
7	3D538G	Column release motor (tilt)

Removal and Installation

1. Remove the steering column. For additional information, refer to Steering Column in this section.

2. Disconnect the 2 column release motor electrical connectors.

3. Remove the 2 rotation sensor screws and the rotation sensor.
   - To install, tighten to 1 Nm (9 lb-in).

4. Remove the 4 screws and the column release motors.
   - To install, tighten to 4 Nm (35 lb-in).

5. To install, reverse the removal procedure.

Steering Column Switches

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Refer to Wiring Diagrams Cell 90 for schematic and connector information.

Refer to Wiring Diagrams Cell 81 for schematic and connector information.

Refer to Wiring Diagrams Cell 128 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Multi-function switch • Ignition key • Ignition switch • Tilt/telescope switch	• Circuitry • Rear battery junction box (RBJB) fuse 22 (20A) • Central junction box (CJB) fuse(s): ♦ 13 (5A) ♦ 17 (5A)

NOTE: For multi-function switch concerns, refer to one of the following sections:

- Exterior Lighting, Section 417-01 .
- Wipers and Washers, Section 501-16 .

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

4. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - CAN, SCP or ISO circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for the front electronic module (FEM), refer to Section 419-10 .
    - No response/not equipped for the instrument cluster module (ICM), refer to Section 413-01 .

5. If DTCs are present, refer to Section 419-10 for FEM-related DTCs, or Section 413-01 for ICM-related DTCs.

6. If no DTCs are present, GO to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart
Pinpoint Tests

Pinpoint Test A: The Ignition Switch Is Inoperative

Normal Operation

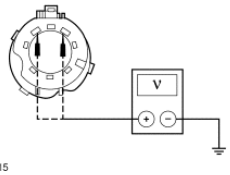
The ignition switch receives overload protected battery voltage from the rear battery junction box (RBJB) fuse 22 (20A) through circuit 30-DA5 (RD/BK). The ignition switch has 4 possible states:

- OFF
- ACC
- RUN
- START

Possible Causes
- Circuit 30-DA5 (RD/BK) open
- Circuit 30-BB20 (RD) open
- Circuit 30-BB9 (RD) open
- Ignition switch
- Instrument cluster

PINPOINT TEST A: THE IGNITION SWITCH IS INOPERATIVE

⚠ CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step	Result / Action to Take
A1 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the ignition switch OK?**	**Yes** GO to A2 . **No** INSTALL a new ignition switch. TEST the system for normal operation.
A2 CHECK CIRCUITS 30-BB20 (RD) AND 30-BB9 (RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Ignition Switch C250. • Measure the voltage between ignition switch C250-7, circuit 30-BB20 (RD), harness side and ground; and between ignition switch C250-1, circuit 30-BB9 (RD), harness side and ground.  A0000315 • **Are the voltages greater than 10 volts?**	**Yes** CHECK the instrument cluster for faults. REFER to Section 413-01 . **No** VERIFY that rear battery juction box (RBJB) fuse 22 is OK. If OK, REPAIR the affected circuit(s). TEST the system for normal operation.

Pinpoint Test B: No Power in ACC

Normal Operation

The ignition switch receives overload protected B+ voltage from the rear battery junction box (RBJB) fuse 22 (20A) through circuit 30-DA5 (RD/BK). The ignition switch has 4 possible states:

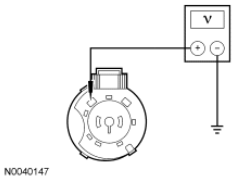
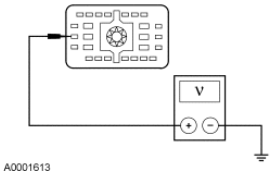
- OFF
- ACC
- RUN
- START

Possible Causes

- Circuit 75-DD1 (YE) open
- Circuit 30-BB20 (RD) open
- Central junction box (CJB) fuse 13 (5A)
- Ignition switch
- Instrument cluster

PINPOINT TEST B: NO POWER IN ACC

⚠ CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step	Result / Action to Take
B1 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the ignition switch OK?**	**Yes** GO to B2 . **No** INSTALL a new ignition switch. TEST the system for normal operation.
B2 CHECK CIRCUIT 30-BB9 (RD) FOR VOLTAGE	
• Disconnect: Ignition Switch C250. • Measure the voltage between ignition switch C250-1, circuit 30-BB9 (RD), harness side and ground.  N0040147 • **Is the voltage greater than 10 volts?**	**Yes** GO to B3 . **No** VERIFY that rear battery junction box (RBJB) fuse 22 is OK. If OK, REPAIR the circuit(s) in question. TEST the system for normal operation.
B3 CHECK CIRCUIT 75-DD1 (YE)	
• Ignition OFF. • Disconnect: Central Junction Box (CJB) C270a. • Ignition ON. • Measure the voltage between the CJB C270a-15, circuit 75-DD1 (YE), harness side and ground.  A0001613 • **Is the voltage greater than 10 volts?**	**Yes** GO to B4 . **No** REPAIR the circuit. TEST the system for normal operation.
B4 CHECK THE CENTRAL JUNCTION BOX (CJB) FUSE 13 (5A)	
• CHECK the CJB fuse 13 (5A).	**Yes** CHECK the instrument cluster for faults. REFER to

• **Is the fuse OK?**	Section 413-01 . **No** INSTALL a new fuse. TEST the system for normal operation.

Pinpoint Test C: No Power In START/RUN

Normal Operation

The ignition switch receives overload protected battery voltage from the battery junction box (BJB) fuse 22 (20A) through circuit 30-DA5 (RD/BK). The ignition switch has 4 possible states:

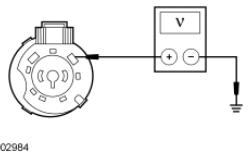
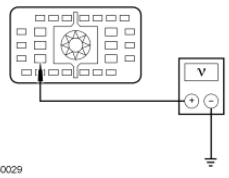
- OFF
- ACC
- RUN
- START

Possible Causes
- Circuit 30-DA5 (RD/BK) open
- CJB fuse 17 (5A)
- Ignition switch
- Instrument cluster

PINPOINT TEST C: NO POWER IN START/RUN

⚠ CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step	Result / Action to Take
C1 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the ignition switch OK?**	**Yes** GO to C2 . **No** INSTALL a new ignition switch. TEST the system for normal operation.
C2 CHECK CIRCUIT 30-BB20 (RD) FOR VOLTAGE	
• Disconnect: Ignition Switch C250. • Measure the voltage between ignition switch C250-7, circuit 30-BB20 (RD), harness side and ground.	**Yes** GO to C3 . **No** VERIFY that rear battery junction box (RBJB) fuse 22 is OK. If OK, REPAIR the affected circuit(s). TEST the system for normal operation.

 N0002984 • **Is the voltage greater than 10 volts?**	
C3 CHECK CIRCUIT 15-DD4 (GN/BK) FOR VOLTAGE	
• Measure the voltage between the CJB C270a-9, circuit 15-DD4 (GN/BK), harness side and ground.  N0040029 • **Is the voltage greater than 10 volts?**	**Yes** GO to C4 . **No** REPAIR the circuit. TEST the system for normal operation.
C4 CHECK CJB FUSE 17 (5A)	
• CHECK the CJB fuse 17 (5A). • **Is the fuse OK?**	**Yes** CHECK the instrument cluster for faults. REFER to Section 413-01 . **No** INSTALL a new fuse. TEST the system for normal operation.

Pinpoint Test D: The Multi-function Switch/Hazard Switch Does Not Operate Correctly

Normal Operation

The multi-function/hazard switch controls the following components:

- Turn signals
- High/low beam/flash-to-pass headlamps
- Wiper/washers
- Hazard lamps

Possible Causes
- Multi-function/hazard switch

PINPOINT TEST D: THE MULTI-FUNCTION SWITCH/HAZARD SWITCH DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
D1 CHECK THE TURN SIGNAL LEVER POSITIONS	

NOTE: Prior to testing, make sure the hazard knob is pushed in fully to the OFF position. • Ignition ON. • Check the turn signal lever in the RH and LH turn positions with the steering wheel locked in the straight-ahead position. Lock the lever in position for each. • Check the lever by slightly holding it in the RH and LH turn positions. When releasing, observe that the lever springs back to normal position. • Road test the vehicle and observe the turn signals for the RH and LH turn positions while manually turning the steering wheel for each position. Verify the lever cancels when the steering returns from the desired turn position. • **Does the turn signal lever operate correctly?**	**Yes** GO to D2 . **No** If the lever will not cancel, CHECK the turn indicator cancel cam for damage. If the lever is worn or damaged, INSTALL a new multi-function switch. REFER to Steering Column Multifunction Switch in this section. TEST the system for normal operation.
D2 CHECK THE HAZARD SWITCH	
• Fully press the hazard switch and release to turn ON the hazard lamps. Verify the switch operation. • Fully press the hazard switch and release to turn OFF the hazard lamps. Verify the switch operation. • **Does the hazard switch operate correctly?**	**Yes** GO to D3 . **No** If the hazard switch is worn or damaged, INSTALL a new multi-function switch. REFER to Steering Column Multifunction Switch in this section. TEST the system for normal operation.
D3 CHECK THE HIGH BEAM AND FLASH-TO-PASS	
• Turn the headlamps ON. • Move the turn signal lever toward the instrument panel to the STOP position. Release the lever. Verify the high beams. • Move the lever back toward the seat. Release the lever. Verify the low beams. • Pull the lever toward the driver seat gently to the flash-to-pass position. Hold the position, and verify both the high and low beams illuminate. • Release the lever. Verify the low beams. • Turn the headlamps OFF. • Pull the lever to the flash-to-pass again and hold. Verify the high beams illuminate. Release the lever. Verify no high beams. • **Does the high beam, low beam and flash-to-pass operate?**	**Yes** GO to D4 . **No** If the lever is worn or damaged, INSTALL a new multi-function switch. REFER to Steering Column Multifunction Switch . TEST the system for normal operation.
D4 CHECK THE WINDSHIELD WIPER AND WASH	

• Rotate the windshield wiper switch to LO, HI and INTERMITTENT positions. Verify the rotation of the switch and wiper operation. • Turn the switch to the OFF position. Verify that the switch rotates to OFF and the wipers stop operating. • Push the end of the switch in toward the center of the steering column to the WASH position. Release the wash position. Verify the wipers operate for a few cycles and return to OFF. • Operate WASH in all speeds of the wiper switch. Verify the wipers return to selected speed after releasing from the WASH position. • **Does the windshield wiper switch and WASH operate correctly?**	**Yes** CHECK the tilt/telescope switch. **No** If the switch or lever is worn or damaged, INSTALL a new wiper switch. REFER to Section 501-16 .

Component Test

Ignition Switch Mechanical Check

Test the mechanical operation of the ignition switch by rotating the lock cylinder through all switch positions. The movement should not stick or bind and should return from the START position back to the ON position without assistance (spring return). If sticking or binding is encountered, check for:

- burrs on the lock cylinder key.
- insufficient lube on the lock cylinder.
- excessive rubbing of the actuator against the transmission shift socket.
- binding lock cylinder.
- shroud rubbing against the lock cylinder.
- burrs or foreign material around the rack and pinion actuator in the lock cylinder housing.
- ⚠ **CAUTION: Do not apply lubricant to the inside of the ignition switch.**

  insufficient lube on the actuator.
- binding ignition switch.

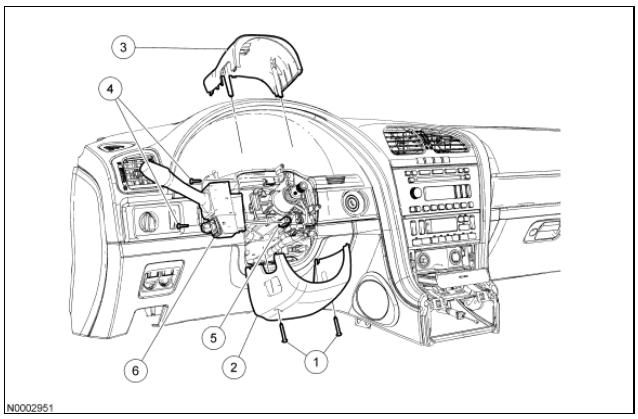
Ignition Switch

Refer to Wiring Diagrams Cell 149 for component testing.

Multifunction Switch

Refer to Wiring Diagrams Cell 149 for component testing.

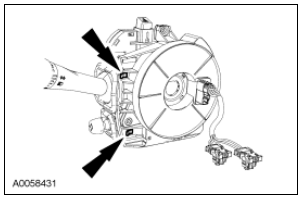
Steering Column Multifunction Switch



Item	Part Number	Description
1	W504246-S	Lower steering column shroud screws (2 required)
2	3533	Lower steering column shroud
3	3530	Upper steering column shroud
4	W390345-S	Multi-function switch screws (2 required)
5	—	Electrical connector (part of 14401)
6	13K359	Multi-function switch

Removal and Installation

1. Remove the steering wheel. For additional information, refer to Section 211-04 .
2. Tilt the steering column all the way down and extend it all the way out.
3. Position the front wheels to the straight-ahead position.
4. Remove the 2 lower steering column shroud screws.
5. Remove the lower steering column shroud.
6. Remove the upper steering column shroud.
7. Remove the 2 multi-function switch screws.
8. Disconnect the electrical connector.
9. Release the 2 tabs and slide the multi-function switch out of the clockspring.



10. To install, reverse the removal procedure.

General Specifications

Item	Specification
A/C Compressor	
A/C compressor type	Visteon SC105V variable scroll
A/C compressor displacement	105 cc (6.4 cu in)
A/C compressor rotation	Clockwise
Magnetic Clutch	
Air gap between pulley and clutch plate	0.35-0.75 mm (0.014-0.030 in)
Refrigerant Lubricant	
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B
Capacity	207 ml (7 oz)
Refrigerant	
R-134a Refrigerant YN-19	WSH-M17B19-A
Capacity	0.79 kg (28 oz)
Refrigerant System Cleaner	
A/C Systems Flushing Solvent YN-23	—
Evaporator Core Orifice	**Thermostatic expansion valve (TXV) system**
Color	—
Diameter	—
A/C Pressure Relief Valve [a]	
Open	3,792-4,137 kPa (550-600 psi)
Pressure Cutoff Switch	—
A/C Pressure Sensor	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

[a] Manifold gauge set pressures may vary slightly depending on the distance between the service gauge port valve and the A/C pressure relief valve locations.

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor clutch nut	18	13	—
A/C (peanut) fitting nut	8	—	71

Climate Control System

⚠ WARNING: To avoid accidental deployment and possible injury, the air bag system backup power supply must be depleted before repairing any climate control components. To deplete the backup power supply, disconnect the battery ground cable and wait one minute.

⚠ WARNING: Carbon monoxide is colorless, odorless and dangerous. If it is necessary to operate the engine with vehicle in a closed area such as a garage, always use an exhaust collector to vent the exhaust gases outside the closed area.

⚠ WARNING: R-134a is classified as a safe refrigerant, but misuse can make it dangerous. The following precautions must be observed:

- Always wear safety goggles when repairing an air conditioning system.
- Avoid contact with liquid refrigerant R-134a. R-134a vaporizes at approximately -25°C (-13°F) under atmospheric pressure and it will freeze skin tissue.
- Never allow refrigerant R-134a gas to escape in quantity in an occupied space. R-134a is non-toxic, but it will displace the oxygen needed to support life.
- Never use a torch in an atmosphere containing R-134a gas. R-134a is non-toxic at all normal conditions, but when it is exposed to high temperatures, such as a torch flame, it decomposes. During decomposition it releases irritating and toxic gases (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.
- Do not allow any portion of the charged air conditioning system to become too hot. The pressure in an air conditioning system rises as the temperature rises and temperatures of approximately 85°C (185°F) can be dangerous.
- Allow the engine to cool sufficiently prior to carrying out maintenance or serious burns and injury can occur.

⚠ CAUTION: To avoid damaging the vehicle or A/C components, the following precautions must be observed:

- The A/C refrigerant of all vehicles must be identified and analyzed prior to refrigerant charging. Failure to do so can contaminate the shop bulk refrigerant and other vehicles.
- Do not add R-12 refrigerant to an A/C system that requires the use of R-134a refrigerant. These 2 types of refrigerant must never be mixed. Doing so can damage the A/C system.
- Charge the A/C system with the engine running using the low-pressure side of the A/C system.
- Use only R-134a refrigerant. Due to environmental concerns, when the air conditioning system is drained, the refrigerant must be collected using refrigerant recovery/recycling equipment. Federal law REQUIRES that R-134a be recovered into appropriate recovery equipment and the process be conducted by qualified technicians who have been certified by an approved organization, such as MACS, ASI, etc. Use of a recovery machine dedicated to R-134a is necessary to reduce the possibility of oil and refrigerant incompatibility concerns. Refer to the instructions provided by the equipment manufacturer when removing refrigerant from or charging the air conditioning system.
- Refrigerant R-134a must not be mixed with air for leak testing or used with air for any other purpose above atmospheric pressure. R-134a is combustible when mixed with high concentrations of air and higher pressures.
- A number of manufacturers are producing refrigerant products that are described as direct substitutes for refrigerant R-134a. The use of any unauthorized substitute refrigerant can severely damage the A/C components. If repair is required, use only new or recycled refrigerant R-134a.

⚠ CAUTION: To avoid contamination of the A/C system:

- Never open or loosen a connection before discharging the system.
- When loosening a connection, if any residual pressure is evident, allow it to leak out before opening the fitting.
- Before charging, evacuate a system that has been opened to install a new component or a system that has discharged through leakage.
- Seal open fittings with a cap or plug immediately after disconnecting a component from the system.
- Clean the outside of the fittings thoroughly before disconnecting a component from the system.
- Do not remove the sealing caps from a new component until ready to install.
- Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use, and install the cap immediately after using. Store the oil in a clean, moisture-free container.
- Install a new O-ring seal before connecting an open fitting. Coat the fitting and the O-ring seal with refrigerant oil before connecting.
- When installing a refrigerant line, avoid sharp bends. Position the line away from the exhaust or any sharp edges that can chafe the line.
- Tighten threaded fittings only to specifications. The steel and aluminum fittings used in the refrigerant system will not tolerate overtightening.
- When disconnecting a fitting, use a wrench on both halves of the fitting to prevent twisting of the refrigerant lines or tubes.
- Do not open a refrigerant system or uncap a new component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component that is cooler than the surrounding air.

The dual automatic temperature control system maintains the selected vehicle interior temperature by heating and/or cooling the air.

- During A/C operation the system also reduces the relative humidity of the air.
- The driver may override the automatic mode of operation.

Principles of Operation

There are 4 main principles involved with the basic theory of operation:

- Heat transfer
- Latent heat of vaporization
- Relative humidity
- Effects of pressure on boiling or condensation

Heat Transfer

If 2 substances of different temperature are placed near each other, the heat in the warmer substance will transfer to the colder substance.

Latent Heat of Vaporization

When a liquid boils (converts to gas) it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (converts back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

Relative Humidity

The amount of moisture (water vapor content) that the air can hold is directly related to the air temperature.

The more heat there is in the air, the more moisture the air can hold. The lower the moisture content in the air, the more comfortable you feel. Removing moisture from the air lowers its relative humidity and improves personal comfort.

Effects of Pressure on Boiling or Condensation

As the pressure is increased on a liquid, the temperature at which the liquid boils (converts to gas) also increases. Conversely, when the pressure on a liquid is reduced, its boiling point is also reduced. When in the gas state, an increase in pressure causes an increase in temperature, while a decrease in pressure will decrease the temperature of the gas.

The Refrigerant Cycle

During stabilized conditions (air conditioning system shutdown), the refrigerant is in a vaporized state and pressures are equal throughout the system. When the A/C compressor is in operation it increases pressure on the refrigerant vapor, raising its temperature. The high-pressure and high-temperature vapor is then released into the top of the A/C condenser core.

The A/C condenser, being close to ambient temperature, causes the refrigerant vapor to condense into a liquid when heat is removed from the refrigerant by ambient air passing over the fins and tubing. The now liquid refrigerant, still at high pressure, exits from the bottom of the A/C condenser and enters the inlet side of the A/C receiver drier. The receiver drier is designed to remove moisture from the refrigerant.

The outlet of the receiver drier is connected to the thermostatic expansion valve (TXV). The TXV provides the orifice which is the restriction in the refrigerant system and separates the high and low pressure sides of the A/C system. As the liquid refrigerant passes across this restriction, its pressure and boiling point are reduced.

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the A/C evaporator, it absorbs heat from the airflow passing over the plate/fin sections of the A/C evaporator. This addition of heat causes the refrigerant to boil (convert to gas). The now cooler air can no longer support the same humidity level of the warmer air and this excess moisture condenses on the exterior of the evaporator coils and fins and drains outside the vehicle.

The refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

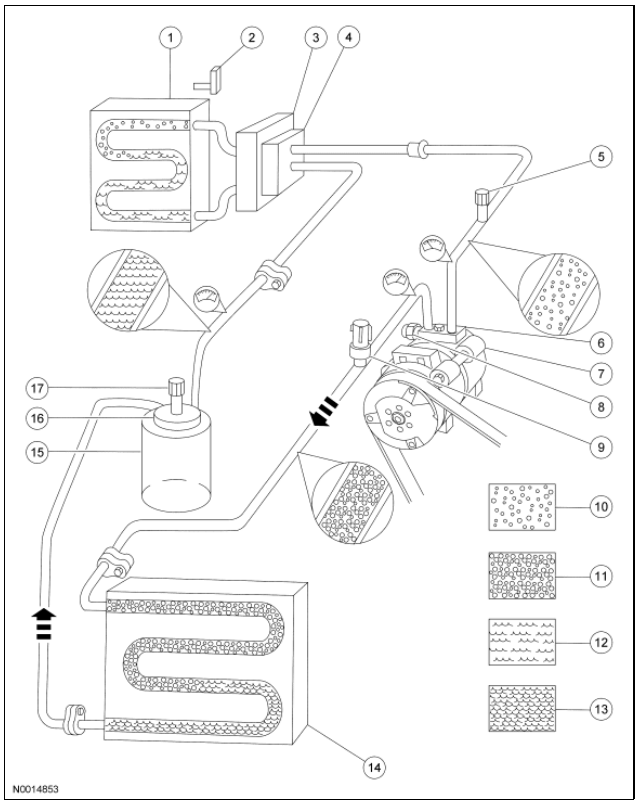
A thermistor which monitors the temperature of the air that has passed through the evaporator core controls A/C clutch cycling. If the temperature of the evaporator core discharge air is low enough to cause the condensed water vapor to freeze, the A/C clutch is disengaged by the vehicle powertrain control module (PCM).

The high-side line pressure is also monitored so that A/C compressor operation will be interrupted if the system pressure becomes too high or is determined to be too low (low charge condition).

The A/C compressor thermal protection switch will interrupt compressor operation if the compressor housing exceeds temperature limits.

The A/C compressor relief valve will open and vent refrigerant to relieve unusually high system pressure.

Clutch Cycling Thermostatic Expansion Valve Type Refrigerant System



Item	Part Number	Description
1	19860	A/C evaporator core
2	19C734	A/C evaporator core outlet temperature thermistor
3	19849	Thermostatic expansion valve
4	19835	Manifold and tube assembly — thermostatic expansion valve
5	19D701	A/C charge valve port (low side)
6	19D734	Manifold and tube assembly — A/C compressor
7	19703	A/C compressor
8	19D644	A/C pressure relief valve
9	19D594	A/C pressure transducer
10	—	Low pressure vapor
11	—	High pressure vapor
12	—	Low pressure liquid
13	—	High pressure liquid
14	19712	A/C condenser core
15	19959	A/C receiver drier
16	19835	Manifold and tube assembly — receiver drier
17	19D701	A/C charge valve port (high side)

Dual Automatic Temperature Control (DATC) Module Description

The DATC system automatically maintains a selected temperature for vehicle interior comfort and regulates the volume of airflow between the instrument panel registers, floor ducts, windshield defroster nozzle and side

window demisters. The system will automatically select between fresh and recirculated air with an optional manual override. The DATC system will also include a manual A/C override, blower speed override and airflow direction overrides.

The dual temperature zone feature provides the driver and the front seat passenger with their own independent temperature set points. The DATC system provides both the driver and front seat passenger with their selected temperature for interior comfort. In situations where the difference between the driver and the front seat passenger set points are very large, the DATC will tend to favor the driver's setting and make the front seat passenger as comfortable as possible.

The driver and front seat passenger will not have independent air distribution mode or fan controls so the system is dual temperature only. In some cases the passenger temperature set point may influence the air distribution mode or blower speed in automatic mode.

System Air Flow

AUTO

When AUTO is selected:

- The temperature control setting(s) are manually set to the desired setting(s).
- The air inlet door actuator is automatically controlled by the DATC module, based on the temperature setting(s), but can be manually overridden by selecting the recirculation button.
- The panel door, floor door and defrost door actuators are automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by selecting any of the air distribution buttons.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).
- The A/C compressor is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by selecting the A/C button. The A/C compressor will not operate if the outside temperature is lower than approximately 2°C (35°F).
- The blower motor is ON. The blower motor speed is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by adjusting the blower speed rocker button.

OFF

When OFF is selected:

- The air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment.
- The floor door actuator positions the floor door in the OPEN position, and the panel door actuator, defrost door actuator, position the panel door and defrost door in the CLOSED position. This closes off airflow to the defrost duct, the side window demisters and the instrument panel A/C registers.
- The dual coolant control valve is in the CLOSED position, preventing the flow of hot coolant to the heater core.
- The blower motor is OFF.

PANEL

When PANEL is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator ON), the air

inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator OFF), the air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The panel door actuator positions the panel door in the OPEN position and the floor door and defrost door actuators position the floor door and defrost door in the CLOSED position, directing airflow to the instrument panel A/C registers.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).
- The A/C request button is enabled. When the A/C request button is selected (indicator ON), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator OFF), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is ON.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator ON), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator OFF), the air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The panel door and floor door actuators position the panel door and floor door in the OPEN position and the defrost door actuator positions the defrost door in the CLOSED position, directing airflow to the instrument panel A/C registers and the floor duct.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).
- The A/C request button is enabled. When the A/C request button is selected (indicator ON), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator OFF), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is ON.

FLOOR

When FLOOR is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator ON), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator OFF), the air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment. The DATC will automatically revert to the outside air position after approximately 1 to 4 minutes to prevent window fogging.
- The floor door actuator positions the floor door in the OPEN position and the panel door and defrost door actuators position the panel door and defrost door in the CLOSED position, directing airflow to the floor duct. A small amount of airflow from the outboard instrument panel A/C registers will be present.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is enabled. When the A/C request button is selected (indicator ON), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator OFF), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is ON.

FLOOR/DEFROST

When FLOOR/DEFROST is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator ON), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator OFF), the air inlet door actuator positions the air inlet door as to admit only outside air into the passenger compartment. The DATC will automatically revert to the outside air position after approximately 1 to 4 minutes to prevent window fogging.
- The floor door and defrost door actuators position the floor door and defrost door in the OPEN position and the panel door actuator positions the panel door in the CLOSED position, directing airflow to the floor duct, the windshield defroster ducts and the side window demisters. A small amount of airflow from the outboard instrument panel A/C registers will be present.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is enabled. When the A/C request button is selected (indicator ON), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator OFF), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is ON.

DEFROST

When DEFROST is selected:

- The Recirc request button is disabled. The air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The defrost door actuator positions the defrost door in the OPEN position and the panel door and floor door actuators position the panel door and floor door in the CLOSED position, directing airflow to the windshield defroster ducts and the side window demisters. A small amount of airflow from the outboard instrument panel A/C registers will be present.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is disabled. To reduce fogging, the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F).
- The blower motor is ON.

Climate Control System

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
ST1928-A	R-134a Manifold Gauge Set 176-R032A or equivalent
ST1501-A	A/C Pressure Test Adapter 412-093 (T94P-19623-E)
ST1252-A	Set, A/C Fittings 412-DS028 (014-00333, D93L-19703B) or equivalent
ST2351-A	Refrigerant Leak Detector 216-00001 or equivalent
ST1474-A	Pressure Test Kit 014-R1072 or equivalent
ST2396-A	Vacuum Check Fitting, TXV 412-129 or equivalent

Inspection and Verification

1. Verify the customer's concern by operating the climate control system to duplicate the condition.
2. Inspect to determine if one of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
	• Auxiliary junction box (AJB) fuse:

• Loose, missing or damaged A/C compressor drive belt • Loose or disconnected A/C clutch • Broken or leaking refrigerant lines • Obstructed in-vehicle temperature sensor • Disconnected in-vehicle temperature aspirator hose • A/C registers are not working (open/close) • Front floor ducts not in place • Incorrectly installed in-vehicle temperature sensor • Incorrectly installed ambient air temperature sensor	♦ 1 (10A) ♦ 11 (15A) ♦ 18 (30A) • Central junction box (CJB) fuse: ♦ 7 (5A) ♦ 14 (5A) ♦ 20 (10A) • Blower motor inoperative • A/C compressor inoperative • Circuit short/open • Disconnected, loose fitting or incorrectly installed electrical connectors and pins • Cooling fan inoperative • Relays not functional or not installed

3. As pinpoint tests and measurements are being carried out, be sure to inspect for any disconnected, loose-fitting or incorrectly installed component, module and in-line electrical connectors and pins.

4. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

5. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the vehicle selection cannot be entered:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.
   - check that the battery voltage is greater than 9V.

If the diagnostic tool still does not allow the vehicle selection to be entered, refer to the diagnostic tool manual.

6. Carry out the Data Link Diagnostic Test using the diagnostic tool. If the diagnostic tool responds with:
   - SCP+, SCP- or UBP circuits fault = ALL MODULE NO RESPONSE/NOT EQUIPPED, go to Module Communication Network Diagnostics to diagnose the network concern.
   - If the powertrain control module (PCM) is not listed for a communication concern, turn the A/C controls to OFF and execute the self-test diagnostics for the PCM.
   - If the DATC module is not listed for a communication concern, execute the self-test diagnostics for the DATC module.

7. If any PCM or DATC DTCs are retrieved, and are related to the concern, go to the Powertrain Control Module Diagnostic Trouble Code (DTC) Index or the Dual Automatic Temperature Control (DATC) Module Diagnostic Trouble Code (DTC) Index in this section to continue the diagnostics.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue the diagnostics.

9. If the DATC module cannot be accessed by the diagnostic tool, GO to Pinpoint Test A .

Dual Electronic Automatic Temperature Control (DATC) Module Diagnostic Trouble Codes — DTCs

If using the diagnostic tool or front panel diagnostics to check for DATC DTCs:

1. Check continuous DTCs.

2. Run DATC self-test. Refer to Front Panel DATC Self-Test (On-Demand Diagnostic Trouble Codes — DTCs).

General Information:

- If the DTC is continuous only and does not appear in the self-test, this indicates an intermittent fault condition, such as a poor wiring connection or a loose terminal. If the DATC does not appear after running the self-test it may also indicate that the DTC may no longer exist.
- If the DTC is continuous and appears in the self-test, this indicates a hard fault. A hard fault suggests a permanent wiring failure, disconnected connector or component failure.

Front Panel DATC Module Self-Test (On-Demand Diagnostic Trouble Codes — DTCs)

On-demand DTCs are those that are reported by an ECU when a failure is detected while executing a diagnostic test. For the DATC module this means that all faults (hard) that occur while the module is conducting a self-test shall be reported as an on-demand DTC.

- The DATC module self-test will not detect concerns associated with data link messages such as engine coolant temperature or vehicle speed signals. The diagnostic tool must be used to retrieve these concerns.
- The vehicle interior temperature should be between 0-32°C (32-90°F) when carrying out the self-test. If the temperatures are not within the specified ranges, false temperature sensor DTCs may be displayed.

The DATC module self-test through the front panel display:

- can be initiated at any time. Normal operation of the system stops when the self-test is activated.
- is entered by pressing the OFF and DEFROST buttons simultaneously and then pressing the AUTO button within 2 seconds. Record all DTCs displayed.
- concludes by reporting all on-demand DTCs. Follow the diagnostics procedure given under ACTION in the DTC index for each DTC given.
- reports individual on-demand DTCs as 4-digit DTCs (less the alpha character).
- will calibrate all the mode doors and check all analog inputs. The DATC module will only report on-demand (hard) faults that occurred while the DATC module was conducting its self-test.
- will light all control panel display segments if no faults are detected.
- will report individual on-demand DTCs without the °C symbol lit.

To exit the self-test, press the DEFROST button. This will clear all on-demand codes from the DATC module memory. If no button is pushed, DTCs will continue to be displayed.

Upon exit from the self-test the DATC module returns to operational status. The DATC module executes a hard (cold boot) reset which places the DATC system in the OFF mode.

If a condition exists but no DTCs appear during the self-test, GO to Symptom Chart Condition: The DATC System Is Inoperative, Intermittent or Incorrect Operation.

Always exit the self-test before powering the system down (system turned OFF).

Front Panel DATC Module Display — Retrieve Continuous Diagnostic Trouble Codes (DTCs)

Continuous DTCs are fault codes recorded by the DATC module which have occurred during normal

operation. For the DATC module this means that all faults (intermittent or hard) that occur while the module is in an operational state shall be reported as a continuous DTC.

- To retrieve continuous DTCs, press the OFF and DEFROST buttons simultaneously, followed by pressing the RECIRC button within 2 seconds.
- The DATC module will report all continuous DTCs to the vacuum fluorescent (VF) display.
- The DATC module will not carry out a self-test; it will only display continuous faults codes which are stored in memory.
- All VF display segments will light if no faults are detected.
- Individual continuous DTCs will be reported with the °C symbol lit.
- DTCs shall be reported as a 4-digit DTC (less the alpha character).
- Pressing the front DEFROST button will exit the retrieve continuous DTCs mode and clear all continuous DTCs from DATC module memory.
- Pressing any other button (other than DEFROST) will exit the retrieve continuous DTCs mode and maintain all continuous DTCs in DATC module memory.
- Upon exit from the retrieve continuous DTCs mode the DATC module returns to operational status. The DATC module executes a hard (cold boot) reset which places the DATC system in the OFF mode.

Diagnostic Trouble Code Index

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
P1460	WOT A/C Cutout Internal Driver Malfunction	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1461	A/C Pressure Sensor Circuit High Input	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1462	A/C Pressure Sensor Circuit Low Input	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1463	A/C Pressure Sensor Insufficient Pressure Variation	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1469	Low A/C Cycling Period	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1474	Low Speed Fan Internal Driver Failure	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1479	High Speed Fan Internal Driver Failure	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1464	A/C Demand Out Of Self-Test Range	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Dual Electronic Automatic Temperature Control (DATC) Module Diagnostic Trouble Code (DTC) Index

DTC	Run-Time (Intermittent) Faults or Self-Test (Hard) Faults	Description	Action to Take
B1242	1242	Air Inlet Door Actuator Circuit Failure	GO to Pinpoint Test C .

B1251	1251	In-Vehicle Temperature Sensor Circuit Open	GO to Pinpoint Test D .
B1253	1253	In-Vehicle Temperature Sensor Circuit Short to Ground	GO to Pinpoint Test D .
B1255	1255	Ambient Air Temperature Sensor Open	GO to Pinpoint Test F .
B1257	1257	Ambient Air Temperature Sensor Short to Ground	GO to Pinpoint Test F .
B1259	1259	A/C Solar Radiation Sensor Open Circuit	GO to Pinpoint Test G .
B1261	1261	A/C Solar Radiation Sensor Circuit Short to Ground	GO to Pinpoint Test G .
B1262	1262	Defrost Door Actuator Circuit Failure	GO to Pinpoint Test C .
B1263	1263	Panel Door Actuator Circuit Failure	GO to Pinpoint Test C .
B1264	1264	Floor Door Actuator Circuit Failure	GO to Pinpoint Test C .
B1265	1265	Cold Air Bypass Door Actuator Circuit Failure	Invalid code. Vehicle not equipped with cold air bypass door actuator. Ignore this code and continue diagnostics.
B1342	1342	ECU Defective	INSTALL a new DATC module.
B1676	1676	Battery Voltage Out of Range	—
B1946	1946	Evaporator Discharge Temperature Sensor Open Circuit	GO to Pinpoint Test E .
B1947	1947	Evaporator Discharge Temperature Sensor Circuit Short to Ground	GO to Pinpoint Test E .
B1966	1966	Driver Heater Core Discharge Temperature Sensor Open Circuit	GO to Pinpoint Test E .
B1967	1967	Driver Heater Core Discharge Temperature Sensor Short Circuit	GO to Pinpoint Test E .
B2428	2428	Passenger Heater Core Discharge Temperature Sensor Open Circuit	GO to Pinpoint Test E .
B2429	2429	Passenger Heater Core Discharge Temperature Sensor Short Circuit	GO to Pinpoint Test E .
B2477	2477	Module Configuration Failure	RECONFIGURE the DATC module.
B2797	2797	Driver Coolant Control Valve Open Circuit	GO to Pinpoint Test J .
B2798	2798	Driver Coolant Control Valve Circuit Short to	GO to Pinpoint Test H .

		Ground	
B2799	2799	Passenger Coolant Control Valve Open Circuit	GO to Pinpoint Test J .
B2800	2800	Passenger Coolant Control Valve Circuit Short to Ground	GO to Pinpoint Test H .
U1041	5041	SCP Invalid Or Missing Data For Function Read Vehicle Speed	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1073	5073	SCP Invalid or Missing Data For Engine Coolant	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1027	5027	SCP Invalid or Missing Data For Engine Rpm	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1178	5178	SCP Invalid or Missing Data For Voice Command	This code will only appear if the vehicle is equipped with voice command.
U1222	5222	SCP Invalid or Missing Data For Interior Lamps	—

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: No Communication With The Dual Automatic Temperature Control (DATC) Module

Normal Operation

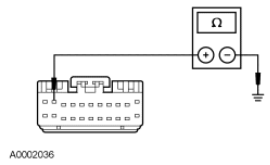
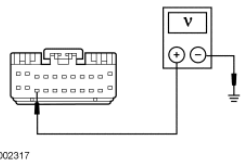
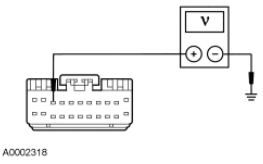
Under normal operation, the dual automatic temperature control (DATC) module receives battery voltage through circuit 29-FA10 (OG/GN) and ignition voltage through circuit 20-FA10 (PK/OG). A ground is provided for the DATC module through circuit 31-FA10 (BK).

Possible Causes

- Fuse(s)
- An open in circuit 29-FA10 (OG/GN), 20-FA10 (PK/OG) or 31-FA10 (BK)
- DATC module

PINPOINT TEST A: NO COMMUNICATION WITH THE DUAL AUTOMATIC TEMPERATURE CONTROL (DATC) MODULE

Test Step	Result / Action to Take
A1 CHECK CIRCUIT 31-FA10 (BK) FOR AN OPEN	

• Disconnect: DATC Module C228a. • Measure the resistance between DATC module C228a-2, circuit 31-FA10 (BK) and ground.  A0002036 • **Is the resistance less than 5 ohms?**	**Yes** GO to A2 . **No** REPAIR circuit 31-FA10 (BK) for an open. TEST the system for normal operation.
A2 CHECK CIRCUIT 29-FA10 (OG/GN) FOR VOLTAGE	
• Ignition ON. • Measure the voltage between DATC module C228a-14, circuit 29-FA10 (OG/GN) and ground.  A0002317 • **Is the voltage greater than 10 volts?**	**Yes** GO to A3 . **No** VERIFY central junction box (CJB) fuse 20 (10A) is OK. If OK, REPAIR circuit 29-FA10 (OG/GN) for an open. TEST the system for normal operation.
A3 CHECK CIRCUIT 20-FA10 (PK/OG) FOR VOLTAGE	
• Ignition ON. • Measure the voltage between DATC module C228a-3, circuit 20-FA10 (PK/OG) and ground.  A0002318 • **Is the voltage greater than 10 volts?**	**Yes** Diagnose the network concern. **No** VERIFY central junction box (CJB) fuse 14 (5A) is OK. If OK, REPAIR circuit 20-FA10 (PK/OG) for an open. TEST the system for normal operation.

Pinpoint Test B: The DATC System Is Inoperative, Intermittent or Incorrect Operation

Normal Operation

Under normal operation, the dual automatic temperature control (DATC) module receives battery voltage through circuit 29-FA10 (OG/GN) and ignition voltage through circuit 20-FA10 (PK/OG). A ground is provided for the DATC module through circuit 31-FA10 (BK).

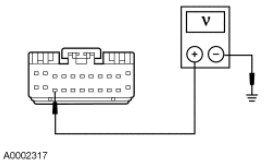
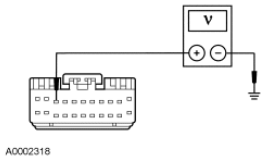
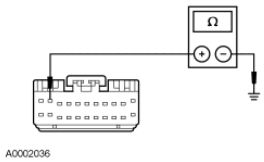
Possible Causes

- Fuse(s)
- An open in circuit 29-FA10 (OG/GN), 20-FA10 (PK/OG) or 31-FA10 (BK)
- DATC module

PINPOINT TEST B: THE DATC SYSTEM IS INOPERATIVE, INTERMITTENT OR INCORRECT OPERATION

Test Step	Result / Action to Take
B1 VERIFY AUTOMATIC OPERATION	
• Ignition ON. • With the engine running, press the AUTOMATIC button. • **Does the indicator above the AUTO button illuminate and the selected temperature for both the driver and passenger appear in the display window?**	**Yes** GO to B2 . **No** GO to B11 .
B2 PERFORM THE DATC MODULE SELF-TEST	
• Ignition ON. • Carry out the DATC module self-test. Record the DTCs displayed, if any. • **Were any DTCs displayed as a result of the DATC self-test?**	**Yes** REFER to the DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as required. **No** GO to B3 .
B3 CHECK THE VACUUM FLUORESCENT DISPLAY	
• Exit self-test by pressing the DEFROST button. Observe the button indicators and function symbols displayed on the vacuum fluorescent display while changing the temperature, blower speed and functions. • **Are the display and indicators correct and complete without any missing elements?**	**Yes** GO to B4 . **No** INSTALL a new DATC module. TEST the system for normal operation.
B4 CHECK THE BLOWER MANUAL OVERRIDE OPERATION	
• Press the blower motor speed override control fully up and down. • **Does the blower motor speed increase from low to high speed?**	**Yes** GO to B5 . **No** If the blower motor is inoperative, GO to Pinpoint Test N .

	If the blower motor does not operate correctly, GO to Pinpoint Test O .
B5 VERIFY THE DEFROST OVERRIDE OPERATION	
• Press the override button for DEFROST operation. • **Is outside air being discharged from the windshield defroster nozzle and the side window demisters?**	**Yes** GO to B6 . **No** GO to Pinpoint Test C .
B6 VERIFY THE FLOOR OVERRIDE OPERATION	
• Press the override button for FLOOR operation. • **Is outside air being discharged from the floor duct?**	**Yes** GO to B7 . **No** GO to Pinpoint Test C .
B7 VERIFY THE VENT OVERRIDE OPERATION	
• Press the override button for VENT operation. • **Is outside air being discharged from the instrument panel registers?**	**Yes** GO to B8 . **No** GO to Pinpoint Test C .
B8 VERIFY THE A/C CLUTCH DOES NOT ENGAGE IN THE VENT MODE	
• Press the override button for VENT operation. • **Does the A/C clutch engage when the VENT override button is pressed?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to B9 .
B9 VERIFY THE RECIRC OVERRIDE OPERATION	
• Press the VENT and RECIRC override buttons. • **Is recirculated air being discharged from the instrument panel registers?**	**Yes** GO to B10 . **No** GO to Pinpoint Test C .
B10 VERIFY A/C CLUTCH ENGAGEMENT IN THE A/C MODE	
• Press the VENT and A/C override buttons for A/C operation. • **Does the A/C clutch engage when the VENT and A/C override buttons are pressed?**	**Yes** The test is complete. The system is functioning normally. **No** GO to Pinpoint Test L .
B11 CHECK THE DATC MODULE FUNCTIONS	
• Press each function button and observe the display.	**Yes** INSTALL a new DATC module. TEST the system for normal operation.

• **Does the DATC perform and display any functions?**	**No** GO to B12 .
B12 CHECK THE VOLTAGE TO THE DATC	
• Ignition OFF. • Disconnect: DATC C228a. • Ignition ON. • Measure the voltage between ground and DATC module C228a-14, circuit 29-FA10 (OG/GN).  A0002317 • Measure the voltage between ground and DATC module C228a-3, circuit 20-FA10 (PK/OG).  A0002318 • **Are the voltages greater than 10 volts?**	**Yes** GO to B13 . **No** VERIFY central junction box (CJB) fuse 20 (10A) and 14 (5A) is OK. If OK, REPAIR the affected circuit for an open. TEST the system for normal operation.
B13 CHECK THE GROUND CIRCUIT TO THE DATC	
• Ignition OFF. • Measure the resistance between DATC module C228a-2, circuit 31-FA10 (BK) and ground.  A0002036 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 31-FA10 (BK) for an open. TEST the system for normal operation.

Pinpoint Test C: Incorrect/Erratic Direction Of Airflow From Outlets

Normal Operation

Under normal operation, to open the mode doors, the DATC module supplies the cold air bypass, air inlet, defrost, panel mode and floor mode door actuator motors voltage through the door actuator open circuits and ground through the door actuator close circuits. To close the mode doors, the DATC module reverses the

voltage and ground circuits.

The mode door actuator feedback resistors are supplied a ground from the DATC module by the mode door actuator return circuits and a 5-volt reference voltage on the mode door actuator reference circuits. The DATC module reads the voltage on the mode door actuator feedback circuits to determine the mode door actuator position by the position of the actuator feedback resistor wiper arm.

- Door actuator open circuits:
  - ♦ Air inlet — 32-FB8 (WH/RD)
  - ♦ Defrost — 32-FB5 (WH/BK)
  - ♦ Panel mode — 32-FB7 (WH)
  - ♦ Floor mode — 32-FB6 (WH/VT)

- Door actuator close circuits:
  - ♦ Air inlet — 33-FB8 (YE/RD)
  - ♦ Defrost — 33-FB5 (YE/VT)
  - ♦ Panel mode — 33-FB7 (YE)
  - ♦ Floor mode — 33-FB6 (YE/VT)

- Door actuator return circuits:
  - ♦ Air inlet — 9-FB8 (BN/RD)
  - ♦ Defrost — 9-FB5 (BN/YE)
  - ♦ Panel mode — 9-FB7 (BN)
  - ♦ Floor mode — 9-FB6 (BN/WH)

- Door actuator reference circuits:
  - ♦ Air inlet — 7-FB8 (YE/RD)
  - ♦ Defrost — 7-FB5 (YE/BK)
  - ♦ Panel mode — 7-FB7 (YE)
  - ♦ Floor mode — 7-FB6 (YE/VT)

- Door actuator feedback circuits:
  - ♦ Air inlet — 8-FB8 (WH/RD)
  - ♦ Defrost — 8-FB5 (WH/BK)
  - ♦ Panel mode — 8-FB7 (WH)
  - ♦ Floor mode — 8-FB6 (WH/VT)

Possible Causes

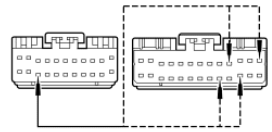
- An open, short to voltage, ground or together in door actuator open, close, return, reference or feedback circuits
- Air inlet, defrost, panel mode and floor mode door actuator motor
- DATC module
- Stuck or bound linkage or door

PINPOINT TEST C: INCORRECT/ERRATIC DIRECTION OF AIRFLOW FROM OUTLETS

Test Step	Result / Action to Take
C1 REQUEST CONTINUOUS DTCs AND CARRY OUT THE DATC SELF-TEST	
• Ignition ON.	**Yes** Record any DTCs displayed. GO to C3 .

• Request Continuous DTCs and carry out the DATC Module Self-Test. Record the DTCs displayed, if any. • **Were any DTCs displayed?**	**No** GO to C2 .
C2 CHECK THE ACTUATOR DOOR AND LINKAGE	
• Inspect the actuator door and linkage for a binding or sticking condition. • **Was a condition found?**	**Yes** REPAIR the door or linkage. TEST the system for normal operation. **No** INSTALL a new DATC module. TEST the system for normal operation.
C3 CHECK THE DOOR ACTUATOR OPEN OPERATION	
• Ignition OFF. • Disconnect: DATC Module C228a. • Disconnect: DATC Module C228b. • Connect a fused jumper wire between DATC module C228a-14, circuit 29-FA10 (OG/GN) and harness side of the connector/pin indicated below that corresponds to the recorded DTC(s).	**Yes** GO to C4 . **No** GO to C5 .

DTC	Pin	Circuit	Actuator/ Door
B1242	C228b-10	32-FB8 (WH/RD)	Air Recirculation
B1262	C228b-13	32-FB5 (WH/BK)	Defrost
B1263	C228b-24	32-FB7 (WH)	Panel Mode
B1264	C228b-22	32-FB6 (WH/VT)	Floor Mode



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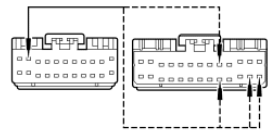
• Connect a fused jumper wire between DATC module C228a-2, circuit 31-FA10 (BK) and harness side of the connector/pin indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Actuator/ Door
B1242	C228b-9	33-FB8 (YE/RD)	Air Recirculation
B1262	C228b-26	33-FB5 (YE/VT)	Defrost
B1263	C228b-25	33-FB7 (YE)	Panel Mode

B1264	C228b-23	33-FB6 (YE/VT)	Floor Mode

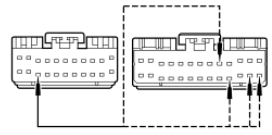


- **Does the actuator motor move in the open direction?**

C4 CHECK THE DOOR ACTUATOR CLOSE OPERATION

- Connect a fused jumper wire between DATC module C228a-14, circuit 29-FA10 (OG/GN) and harness side of the connector/pin indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Actuator/ Door
B1242	C228b-9	33-FB8 (YE/RD)	Air Recirculation
B1262	C228b-26	33-FB5 (YE/VT)	Defrost
B1263	C228b-25	33-FB7 (YE)	Panel Mode
B1264	C228b-23	33-FB6 (YE/VT)	Floor Mode

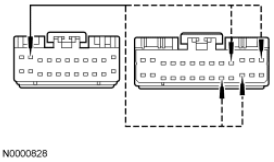


- Connect a fused jumper wire between DATC module C228a-2, circuit 31-FA10 (BK) and harness side of the connector/pin indicated below that corresponds to the recorded DTC(s).

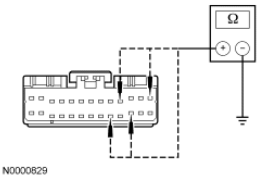
DTC	Pin	Circuit	Actuator/ Door
B1242	C228b-10	32-FB8 (WH/RD)	Air Recirculation
B1262	C228b-13	32-FB5 (WH/BK)	Defrost
B1263	C228b-24	32-FB7 (WH)	Panel Mode
B1264	C228b-22	32-FB6 (WH/VT)	Floor Mode

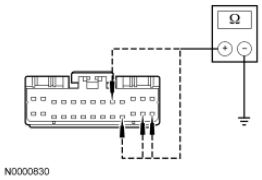
Yes
GO to C11 .

No
GO to C5 .



- **Does the actuator motor move in the closed direction?**

C5 CHECK ACTUATOR MOTOR OPEN CIRCUIT FOR A SHORT TO GROUND	
• Disconnect: Affected Actuator. • Measure the resistance between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground. **DTC / Pin / Circuit** B1242 / C228b-10 / 32-FB8 (WH/RD) B1262 / C228b-13 / 32-FB5 (WH/BK) B1263 / C228b-24 / 32-FB7 (WH) B1264 / C228b-22 / 32-FB6 (WH/VT)  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C6 . **No** REPAIR the affected circuit for a short to ground. TEST the system for normal operation.
C6 CHECK ACTUATOR MOTOR CLOSE CIRCUIT FOR A SHORT TO GROUND	
• Measure the resistance between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground. **DTC / Pin / Circuit** B1242 / C228b-9 / 33-FB8 (YE/RD) B1262 / C228b-26 / 33-FB5 (YE/VT) B1263 / C228b-25 / 33-FB7 (YE) B1264 / C228b-23 / 33-FB6 (YE/VT)	**Yes** GO to C7 . **No** REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

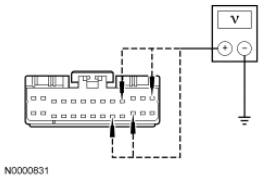


- **Is the resistance greater than 10,000 ohms?**

C7 CHECK ACTUATOR MOTOR OPEN CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure the voltage between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

DTC	Pin	Circuit
B1242	C228b-10	32-FB8 (WH/RD)
B1262	C228b-13	32-FB5 (WH/BK)
B1263	C228b-24	32-FB7 (WH)
B1264	C228b-22	32-FB6 (WH/VT)



- **Is voltage present?**

Yes
REPAIR the affected circuit for a short to voltage. TEST the system for normal operation.

No
GO to C8 .

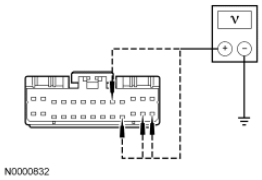
C8 CHECK ACTUATOR MOTOR CLOSE CIRCUIT FOR A SHORT TO VOLTAGE

- Measure the voltage between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

DTC	Pin	Circuit
B1242	C228b-9	33-FB8 (YE/RD)
B1262	C228b-26	33-FB5 (YE/VT)
B1263	C228b-25	33-FB7 (YE)
B1264	C228b-23	33-FB6 (YE/VT)

Yes
REPAIR the affected circuit for a short to voltage. TEST the system for normal operation.

No
GO to C9 .

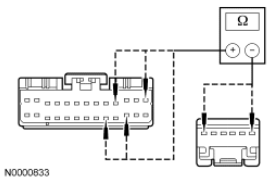


- **Is voltage present?**

C9 CHECK ACTUATOR MOTOR OPEN CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin
B1242	C228b-10	32-FB8 (WH/RD)	C289-6
B1262	C228b-13	32-FB5 (WH/BK)	C232-6
B1263	C228b-24	32-FB7 (WH)	C236-6
B1264	C228b-22	32-FB6 (WH/VT)	C234-1



- **Is the resistance less than 5 ohms?**

Yes
GO to C10 .

No
REPAIR the affected circuit for an open. TEST the system for normal operation.

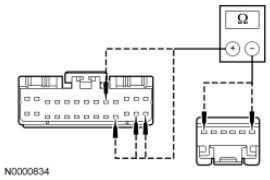
C10 CHECK ACTUATOR MOTOR CLOSE CIRCUIT FOR AN OPEN

- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin
B1242	C228b-9	33-FB8 (YE/RD)	C289-1
B1262	C228b-26	33-FB5 (YE/VT)	C232-1
B1263	C228b-25	33-FB7 (YE)	C236-1
B1264	C228b-23	33-FB6 (YE/VT)	C234-6

Yes
INSPECT for binding or stuck linkage/door. If no condition is found, INSTALL a new door actuator. TEST the system for normal operation.

No
REPAIR the affected circuit for an open. TEST the system for normal operation.

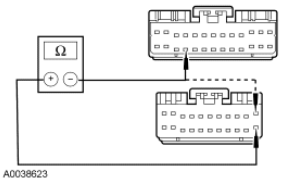


- **Is the resistance less than 5 ohms?**

C11 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE

- Connect: Affected Actuator.
- Disconnect: Actuators Not Affected.
- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1242	C228a-11	9-FB8 (BN/RD)	C228a-22	7-FA1 (YE/RD)
B1262	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE/RD)
B1263	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE/RD)
B1264	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE/RD)



- **Is the resistance between 5,000 and 6,000 ohms?**

Yes
GO to C12 .

No
If the resistance is greater than 6,000 ohms, GO to C14 . If the resistance is less than 5,000 ohms, GO to C22 .

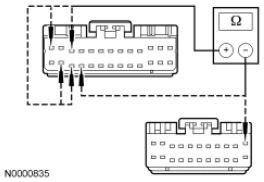
C12 CHECK POTENTIOMETER LOW SIDE RESISTANCE

- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1242	C228a-11	9-FB8 (BN/RD)	C228b-15	8-FB8 (WH/RD)
B1262	C228b-17	9-FA2 (BN/RD)	C228b-1	8-FB5 (WH/BK)
B1263	C228b-17	9-FA2 (BN/RD)	C228b-3	8-FB7 (WH)
B1264	C228b-17	9-FA2 (BN/RD)	C228b-16	8-FB6 (WH/VT)

Yes
GO to C13 .

No
If the resistance is greater than 5,250 ohms, GO to C15 . If the resistance is less than 250 ohms, GO to C23 .

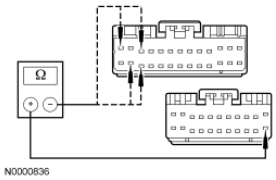


- **Is the resistance between 250 and 5,250 ohms?**

C13 CHECK POTENTIOMETER HIGH SIDE RESISTANCE

- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1242	C228a-22	7-FA1 (YE/RD)	C228b-15	8-FB8 (WH/RD)
B1262	C228b-22	7-FA1 (YE/RD)	C228b-1	8-FB5 (WH/BK)
B1263	C228b-22	7-FA1 (YE/RD)	C228b-3	8-FB7 (WH)
B1264	C228b-22	7-FA1 (YE/RD)	C228b-16	8-FB6 (WH/VT)



- **Is the resistance between 250 and 5,250 ohms?**

Yes
GO to C17 .

No
If the resistance is greater than 5,250 ohms, GO to C14 . If the resistance is less than 250 ohms, GO to C24 .

C14 CHECK THE ACTUATOR REFERENCE CIRCUIT FOR AN OPEN

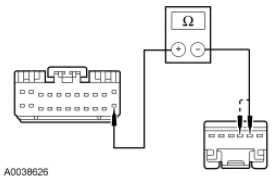
- Disconnect: Affected Actuator.
- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1242	C228a-22	7-FA1 (YE/RD)	C289-4	7-FB8 (YE/RD)
B1262	C228b-22	7-FA1 (YE/RD)	C232-4	7-FB5 (YE/BK)

Yes
GO to C15 .

No
REPAIR the affected circuit for an open. TEST the system for normal operation.

B1263	C228b-22	7-FA1 (YE/RD)	C236-4	7-FB7 (YE)
B1264	C228b-22	7-FA1 (YE/RD)	C234-5	7-FB6 (YE/VT)



- **Is the resistance less than 5 ohms?**

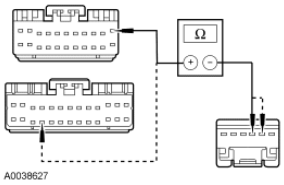
C15 CHECK THE ACTUATOR RETURN CIRCUIT FOR AN OPEN

- Disconnect: Affected Actuator.
- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

Yes
GO to C16 .

No
REPAIR the affected circuit for an open. TEST the system for normal operation.

DTC	Pin	Circuit	Pin	Circuit
B1242	C228a-11	9-FB8 (BN/RD)	C289-5	9-FB8 (BN/RD)
B1262	C228b-17	9-FA2 (BN/RD)	C232-5	9-FB5 (BN/YE)
B1263	C228b-17	9-FA2 (BN/RD)	C236-5	9-FB7 (BN)
B1264	C228b-17	9-FA2 (BN/RD)	C234-4	9-FB6 (BN/WH)



- **Is the resistance less than 5 ohms?**

C16 CHECK THE ACTUATOR FEEDBACK CIRCUIT FOR AN OPEN

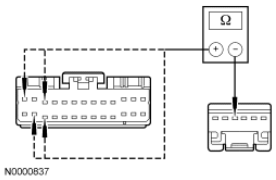
- Disconnect: Affected Actuator.
- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

Yes
INSTALL a new door actuator. TEST the system for normal operation.

No
REPAIR the affected circuit for an open. TEST the system for normal operation.

DTC	Pin	Circuit	Pin
B1242	C228b-15	8-FB8 (WH/RD)	C289-3
B1262	C228b-1	8-FB5 (WH/BK)	C232-3

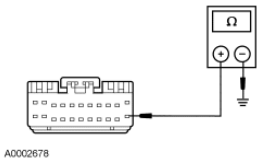
B1263	C228b-3	8-FB7 (WH)	C236-3
B1264	C228b-16	8-FB6 (WH/VT)	C234-3



- **Is the resistance less than 5 ohms?**

C17 CHECK THE ACTUATOR REFERENCE CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between DATC module C228a-22, circuit 7-FA1 (YE/RD) and ground.



- **Is the resistance greater than 10,000 ohms?**

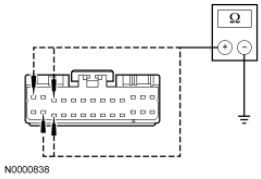
Yes
GO to C18 .

No
REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

C18 CHECK THE ACTUATOR FEEDBACK CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

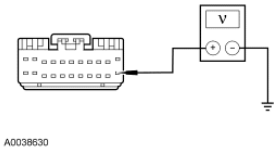
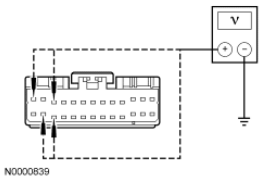
DTC	Pin	Circuit
B1242	C228b-15	8-FB8 (WH/RD)
B1262	C228b-1	8-FB5 (WH/BK)
B1263	C228b-3	8-FB7 (WH)
B1264	C228b-16	8-FB6 (WH/VT)



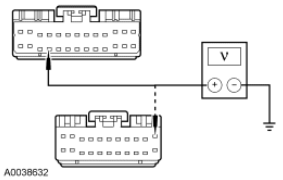
- **Is the resistance greater than 10,000 ohms?**

Yes
GO to C19 .

No
REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

C19 CHECK THE ACTUATOR REFERENCE CIRCUIT FOR A SHORT TO VOLTAGE	
• Measure the voltage between DATC module C228a-22, circuit 7-FA1 (YE/RD) and ground.  A0038630 • **Is voltage present?**	**Yes** REPAIR the affected circuit for a short to voltage. TEST the system for normal operation. **No** GO to C20 .
C20 CHECK THE ACTUATOR FEEDBACK CIRCUIT FOR A SHORT TO VOLTAGE	
• Measure the voltage between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground. **DTC / Pin / Circuit** B1242 / C228b-15 / 8-FB8 (WH/RD) B1262 / C228b-1 / 8-FB5 (WH/BK) B1263 / C228b-3 / 8-FB7 (WH) B1264 / C228b-16 / 8-FB6 (WH/VT)  N0000839 • **Is voltage present?**	**Yes** REPAIR the affected circuit for a short to voltage. TEST the system for normal operation. **No** GO to C21 .
C21 CHECK THE ACTUATOR RETURN CIRCUIT FOR A SHORT TO VOLTAGE	
• Measure the voltage between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground. **DTC / Pin / Circuit** B1242 / C228a-11 / 9-FB8 (BN/RD)	**Yes** REPAIR the affected circuit for a short to voltage. TEST the system for normal operation. **No** INSTALL a new DATC module. TEST the system for normal operation.

B1262	C228b-17	9-FA2 (BN/RD)
B1263	C228b-17	9-FA2 (BN/RD)
B1264	C228b-17	9-FA2 (BN/RD)

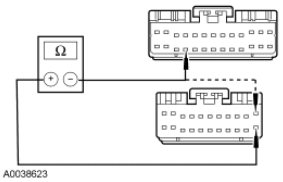


- **Is voltage present?**

C22 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE SHORT TOGETHER

- Disconnect: Affected Actuator.
- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1242	C228a-11	9-FB8 (BN/RD)	C228a-22	7-FA1 (YE/RD)
B1262	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE/RD)
B1263	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE/RD)
B1264	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE/RD)



- **Is the resistance less than 5 ohms?**

Yes
REPAIR the affected circuits for a short together. TEST the system for normal operation.

No
INSTALL a new door actuator. TEST the system for normal operation.

C23 CHECK POTENTIOMETER LOW SIDE RESISTANCE SHORT TOGETHER

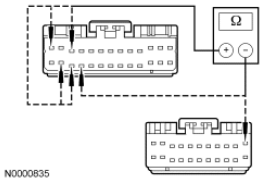
- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1242	C228a-11	9-FB8 (BN/RD)	C228b-15	8-FB8 (WH/RD)

Yes
REPAIR the affected circuits for a short together. TEST the system for normal operation.

No
INSTALL a new door actuator. TEST the system for normal operation.

B1262	C228b-17	9-FA2 (BN/RD)	C228b-1	8-FB5 (WH/BK)
B1263	C228b-17	9-FA2 (BN/RD)	C228b-3	8-FB7 (WH)
B1264	C228b-17	9-FA2 (BN/RD)	C228b-16	8-FB6 (WH/VT)

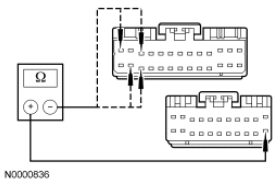


- **Is the resistance less than 5 ohms?**

C24 CHECK POTENTIOMETER HIGH SIDE RESISTANCE SHORT TOGETHER

- Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1242	C228a-22	7-FA1 (YE/RD)	C228b-15	8-FB8 (WH/RD)
B1262	C228a-22	7-FA1 (YE/RD)	C228b-1	8-FB5 (WH/BK)
B1263	C228a-22	7-FA1 (YE/RD)	C228b-3	8-FB7 (WH)
B1264	C228a-22	7-FA1 (YE/RD)	C228b-16	8-FB6 (WH/VT)



- **Is the resistance less than 5 ohms?**

Yes
REPAIR the affected circuits for a short together. TEST the system for normal operation.

No
INSTALL a new door actuator. TEST the system for normal operation.

Pinpoint Test D: DTC B1251 OR DTC 1253 — A/C In-Vehicle Temperature Sensor Open Circuit or Short to Ground

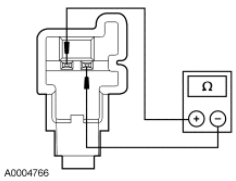
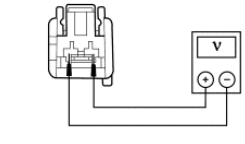
Normal Operation

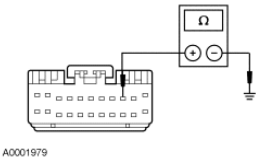
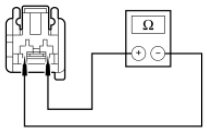
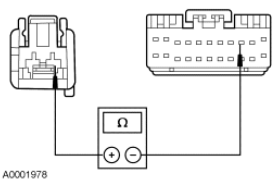
Under normal operation, the in-vehicle temperature sensor receives a ground from the dual automatic temperature control (DATC) module through circuit 9-FA48 (BN/GN). A 5-volt reference voltage is supplied to the in-vehicle temperature sensor from the DATC module through circuit 8-FA48 (WH/GN).

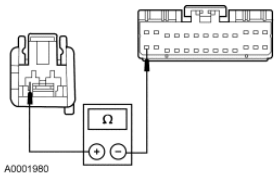
Possible Causes

- An open in circuit 9-FA48 (BN/GN) or 8-FA48 (WH/GN)
- A short together in circuits 9-FA48 (BN/GN) and 8-FA48 (WH/GN)
- A short to ground in circuit 8-FA48 (WH/GN)
- DATC module
- In-vehicle air temperature sensor

PINPOINT TEST D: DTC B1251 OR DTC1253 — A/C IN-VEHICLE TEMPERATURE SENSOR OPEN CIRCUIT OR SHORT TO GROUND

Test Step	Result / Action to Take
D1 CHECK THE SENSOR RESISTANCE	
• Ignition OFF. • Disconnect: In-Vehicle Temperature Sensor C233. • Measure the resistance between in-vehicle temperature sensor terminals.  A0004766 • **Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F) 37,000-58,000 ohms; 20-30°C (68-86°F) 24,000-37,000 ohms; 30-40°C (86-104°F) 16,000-24,000 ohms?**	**Yes** GO to D2 . **No** INSTALL a new in-vehicle temperature sensor. TEST the system for normal operation.
D2 CHECK THE DATC SENSOR OUTPUT VOLTAGE	
• Ignition ON. • Measure the voltage between in-vehicle temperature sensor C233-2, circuits 9-FA48 (BN/GN) and C233-1, circuit 8-FA48 (WH/GN).  A0001977	**Yes** INSTALL a new in-vehicle temperature sensor. TEST the system for normal operation. If the code returns, INSTALL a new DATC module. TEST the system for normal operation. **No** If DTC B1253 is present, GO to D3 . If DTC B1251 is present, GO to D5 .

• **Is the voltage between 4.7 and 5.1 volts?**	
D3 CHECK CIRCUIT 8-FA48 (WH/GN) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: DATC Module C228a. • Disconnect: DATC Module C228b. • Measure the resistance between DATC module C228a-9, circuit 8-FA48 (WH/GN) and ground.  A0001979 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D4 . **No** REPAIR circuit 8-FA48 (WH/GN) for a short to ground. TEST the system for normal operation.
D4 CHECK CIRCUIT 8-FA48 (WH/GN) FOR A SHORT TO CIRCUIT 9-FA48 (BN/GN)	
• Measure the resistance between in-vehicle temperature sensor C233-2, circuits 9-FA48 (BN/GN) and C233-1, circuit 8-FA48 (WH/GN).  A0052122 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 8-FA48 (WH/GN) for a short to circuit 9-FA48 (BN/GN). TEST the system for normal operation.
D5 CHECK CIRCUIT 8-FA48 (WH/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: DATC Module C228a. • Measure the resistance between DATC module C228a-9, circuit 8-FA48 (WH/GN) and the in-vehicle temperature sensor C233-1, circuit 8-FA48 (WH/GN).  A0001978 • **Is the resistance less than 5 ohms?**	**Yes** GO to D6 . **No** REPAIR circuit 8-FA48 (WH/GN) for an open. TEST the system for normal operation.

D6 CHECK CIRCUIT 9-FA48 (BN/GN) FOR AN OPEN	
• Disconnect: DATC Module C228b. • Measure the resistance between DATC pin C228b-14, circuit 9-FA48 (BN/GN) and the in-vehicle temperature sensor C233-2, circuit 9-FA48 (BN/GN).  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 9-FA48 (BN/GN) for an open. TEST the system for normal operation.

Pinpoint Test E: Evaporator Or Heater Core Discharge Air Temperature Sensor Circuit Open Or Short To Ground

Normal Operation

Under normal operation, the LH and RH discharge temperature sensors receive a ground from the dual automatic temperature control (DATC) module through circuit (LH) 9-FA47 (BN/GN)/9-FA3 (BN/RD) and (RH) 9-FA51 (BN/YE)/9-FA3 (BN/RD). The evaporator discharge temperature sensor receives a ground from the DATC module through circuit 9-FA44 (BN/RD).

A 5-volt reference voltage is supplied to the LH and RH discharge temperature sensors from the DATC module through circuits (LH) 8-FA47 (WH/GN) and (RH) 8-FA51 (WH/BK). A 5-volt reference voltage is supplied to the evaporator discharge temperature sensor from the DATC module through circuit 8-FA44 (WH/RD).

Possible Causes

- An open in circuit 9-FA47 (BN/GN), 9-FA51 (BN/YE), 9-FA3 (BN/RD), 9-FA44 (BN/RD), 8-FA47 (WH/GN), 8-FA51 (WH/BK) or 8-FA44 (WH/RD)
- A short together in circuits 8-FA44 (WH/RD) and 9-FA44 (BN/RD), 8-FA51 (WH/BK) and 9-FA51 (BN/YE), 8-FA47 (WH/GN) and 9-FA47 (BN/GN)
- A short to ground in circuit 8-FA47 (WH/GN), 8-FA51 (WH/BK) or 8-FA44 (WH/RD)
- LH discharge temperature sensor
- RH discharge temperature sensor
- Evaporator discharge temperature sensor
- DATC module

PINPOINT TEST E: EVAPORATOR OR HEATER CORE DISCHARGE AIR TEMPERATURE SENSOR CIRCUIT OPEN OR SHORT TO GROUND

NOTE: Evaporator core, driver side heater core and passenger side heater core discharge air temperature sensors have the same diagnostic procedure.

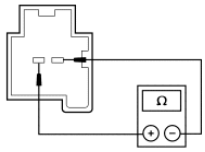
Test Step	Result / Action to Take

E1 CHECK THE SENSOR RESISTANCE

- Ignition OFF.
- Disconnect: Sensor.
- Refer to the table and disconnect the sensor associated with the DTCs recorded from the DATC module self-test:

Sensor	Condition	DTC	Connector
EVAP air discharge	Open	B1946	C296
EVAP air discharge	Short	B1947	C296
Driver air	Open	B1966	C255
Driver air	Short	B1967	C255
Passenger air	Open	B2428	C235
Passenger air	Short	B2429	C235

- Measure the resistance between sensor terminals.



A0004761

- **Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F) 37,000-58,000 ohms; 20-30°C (68-86°F) 24,000-37,000 ohms; 30-40°C (86-104°F) 16,000-24,000 ohms?**

Yes
GO to E2 .

No
INSTALL a new sensor. TEST the system for normal operation.

E2 CHECK THE DATC SENSOR OUTPUT VOLTAGE

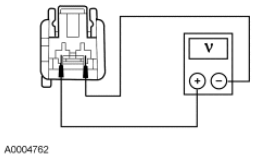
- Ignition ON.
- Refer to the following chart and measure the voltage between temperature sensor harness side circuits.

Connector	Circuit	Circuit
C296	8-FA44 (WH/RD)	9-FA44 (BN/RD)
C255	8-FA51 (WH/BK)	9-FA51 (BN/YE)
C235	8-FA47 (WH/GN)	9-FA47 (BN/GN)

Yes
INSTALL a new sensor. TEST the system for normal operation. If the code returns, INSTALL a new DATC module. TEST the system for normal operation.

No
If DTC B1946, B1966 or B2428 is present,GO to E3 .

If DTC B1947, B1967 or B2429 is present, GO to E5 .

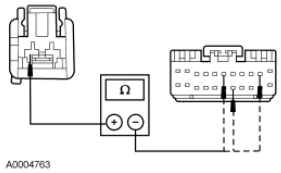


- **Is the voltage between 4.7 and 5.1 volts?**

E3 CHECK THE REFERENCE CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: DATC Module C228a.
- Refer to the following chart and measure the resistance of the reference circuit between DATC module C228a and the sensor connector.

Sensor	Connector	Circuit	DATC C228a Pin
EVAP Discharge	C296	8-FA44 (WH/RD)	10
Passenger Side	C255	8-FA51 (WH/BK)	6
Driver	C235	8-FA47 (WH/GN)	18



- **Is the resistance less than 5 ohms?**

Yes
GO to E4 .

No
REPAIR the affected circuit for an open. TEST the system for normal operation.

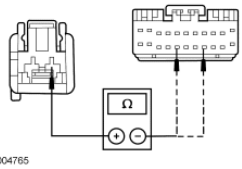
E4 CHECK RETURN CIRCUIT FOR AN OPEN

- Refer to the following chart and measure the resistance of the return circuit between sensor and DATC module C228a for an open.

Sensor Connector	DATC Module C228a Pin	Circuit
Evap/C296	16	9-FA44 (BN/RD)
Passenger/C255	19	9-FA51 (BN/YE)
Driver/C235	19	9-FA47 (BN/GN)

Yes
INSTALL a new DATC module. TEST the system for normal operation.

No
REPAIR the affected circuit for an open. TEST the system for normal operation.

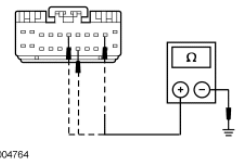


- **Is the resistance less than 5 ohms?**

E5 CHECK THE REFERENCE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: DATC Module C228a.
- Refer to the following chart and measure the resistance of the sensor reference circuit between DATC module C228a and ground.

Temperature Sensor	DATC Module C228a Pin	Circuit
Evaporator Core	10	8-FA44 (WH/RD)
Passenger	6	8-FA51 (WH/BK)
Driver	18	8-FA47 (WH/GN)



- **Is the resistance greater than 10,000 ohms?**

Yes
GO to E6 .

No
REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

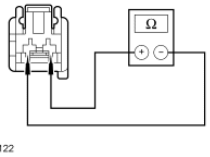
E6 CHECK THE REFERENCE CIRCUITS FOR A SHORT TO THE RETURN CIRCUITS

- Refer to the following chart and measure the resistance between temperature sensor harness side circuits.

Connector	Circuit	Circuit
C296	8-FA44 (WH/RD)	9-FA44 (BN/RD)
C255	8-FA51 (WH/BK)	9-FA51 (BN/YE)
C235	8-FA47 (WH/GN)	9-FA47 (BN/GN)

Yes
INSTALL a new DATC module. TEST the system for normal operation.

No
REPAIR the reference circuit for a short to the return circuit. TEST the system for normal operation.

 A0052122 • **Is the resistance greater than 10,000 ohms?**	

Pinpoint Test F: DTC B1255 OR DTC B1257 — A/C Ambient Temperature Sensor Open Circuit or Short to Ground

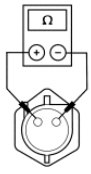
Normal Operation

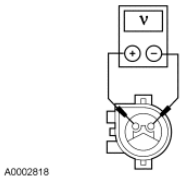
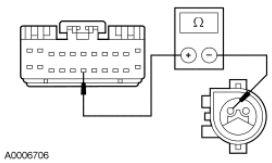
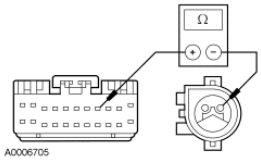
Under normal operation, the ambient air temperature sensor receives a ground from the dual automatic temperature control (DATC) module through circuit 9-FA49 (BN/WH). A 5-volt reference voltage is supplied to the ambient air temperature sensor from the DATC module through circuit 8-FA49 (WH/VT).

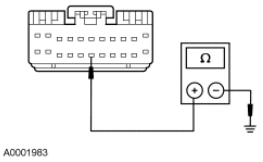
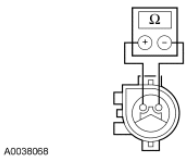
Possible Causes

- An open in circuit 9-FA49 (BN/WH) or 8-FA49 (WH/VT)
- A short to together in circuits 9-FA49 (BN/WH) and 8-FA49 (WH/VT)
- A short to ground in circuit 8-FA49 (WH/VT)
- Ambient air temperature sensor
- DATC module

PINPOINT TEST F: DTC B1255 OR DTC B1257 — A/C AMBIENT TEMPERATURE SENSOR OPEN CIRCUIT OR SHORT TO GROUND

Test Step	Result / Action to Take
F1 CHECK THE AMBIENT TEMPERATURE SENSOR RESISTANCE	
• Ignition OFF. • Disconnect: Ambient Temperature Sensor C132. • Measure the resistance between ambient temperature sensor terminals.  A0002817 • **Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F) 37,000-58,000 ohms; 20-30°C (68-86°F) 24,000-37,000 ohms; 30-40°C (86-104°F) 16,000-24,000 ohms?**	**Yes** GO to F2 . **No** INSTALL a new A/C ambient air temperature sensor. TEST the system for normal operation.

F2 CHECK THE DATC SENSOR OUTPUT VOLTAGE	
• Ignition ON. • Measure the voltage between ambient temperature sensor C132-1, circuits 8-FA49 (WH/VT) and C132-2, circuit 9-FA49 (BN/WH).  A0002818 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** INSTALL a new A/C ambient air temperature sensor. TEST the system for normal operation. If the code returns, INSTALL a new DATC module. TEST the system for normal operation. **No** If DTC B1255, GO to F3 . If DTC B1257, GO to F5 .
F3 CHECK CIRCUIT 8-FA49 (WH/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: DATC Module C228a. • Measure the resistance between DATC module C228a-17, circuit 8-FA49 (WH/VT) and ambient temperature sensor connector C132-1, circuit 8-FA49 (WH/VT).  A0006706 • **Is the resistance less than 5 ohms?**	**Yes** GO to F4 . **No** REPAIR circuit 8-FA49 (WH/VT) for an open. TEST the system for normal operation.
F4 CHECK CIRCUIT 9-FA49 (BN/WH) FOR AN OPEN	
• Measure the resistance between DATC module C228a-8, circuit 9-FA49 (BN/WH) and the ambient temperature sensor connector C132-2, circuit 9-FA49 (BN/WH).  A0006705 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 9-FA49 (BN/WH) for an open. TEST the system for normal operation.
F5 CHECK CIRCUIT 8-FA49 (WH/VT) FOR A SHORT TO GROUND	

• Ignition OFF. • Disconnect: DATC Module C228a. • Measure the resistance between DATC module C228a-17, circuit 8-FA49 (WH/VT) and ground.  A0001983 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to F6 . **No** REPAIR circuit 8-FA49 (WH/VT) for a short to ground. TEST the system for normal operation.
F6 CHECK CIRCUIT 8-FA49 (WH/VT) FOR A SHORT TO CIRCUIT 9-FA49 (BN/WH)	
• Measure the resistance between in-vehicle temperature sensor C132-1, circuits 8-FA49 (WH/VT) and C132-2, circuit 9-FA49 (BN/WH).  A0038068 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 8-FA49 (WH/VT) for a short to circuit 9-FA49 (BN/WH). TEST the system for normal operation.

Pinpoint Test G: DTC B1259 OR DTC B1261 — Solar Radiation Sensor Open Circuit or Short to Ground

Normal Operation

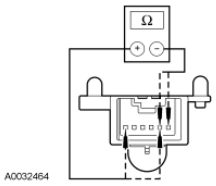
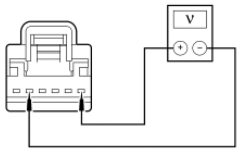
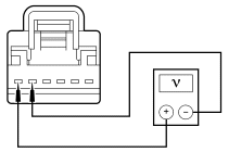
Under normal operation, the solar radiation sensor receives a ground through circuit 31-LE42 (BK/OG). A 5-volt reference voltage is supplied to the solar radiation sensor from the DATC module through circuits 8-FA53 (WH/BL) and 10-FA53 (GY/VT).

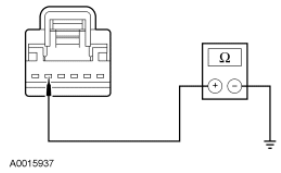
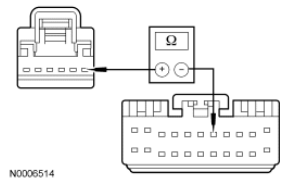
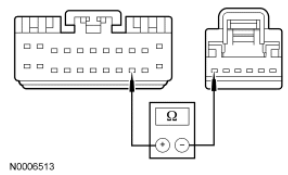
Possible Causes

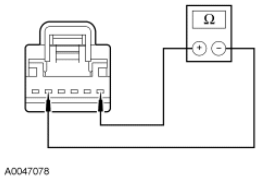
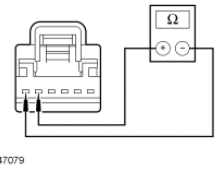
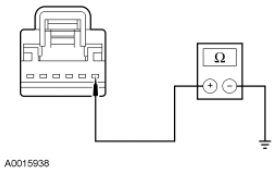
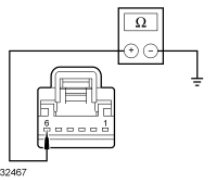
- An open in circuit 31-LE42 (BK/OG), 8-FA53 (WH/BL) or 10-FA53 (GY/VT)
- A short together in circuits 9-FA48 (BN/GN) and 8-FA48 (WH/GN) or 9-FA48 (BN/GN) and 10-FA53 (GY/VT)
- A short to ground in circuit 8-FA53 (WH/BL) or10-FA53 (GY/VT)
- Solar radiation sensor
- DATC module

PINPOINT TEST G: DTC B1259 OR DTC B1261 — SOLAR RADIATION SENSOR OPEN CIRCUIT OR SHORT TO GROUND

Test Step	Result / Action to Take

G1 CHECK THE SOLAR RADIATION SENSOR RESISTANCE	
• Ignition OFF. • Disconnect: Solar Radiation Sensor C286. • Measure the resistance between solar radiation sensor terminals 1 and 5 and between 5 and 6, component side.  A0032464 • **Is continuity present and the resistance greater than 0 ohms?**	**Yes** GO to G2 . **No** INSTALL a new solar radiation sensor. TEST the system for normal operation.
G2 CHECK THE SOLAR RADIATION SENSOR REFERENCE VOLTAGE	
• Ignition ON. • Press the AUTOMATIC button. • Measure the voltage between solar radiation sensor C286-1, circuit 8-FA53 (WH/BL) and C286-5, circuit 31-LE42 (BK/OG).  A0015935 • Measure the voltage between solar radiation sensor C286-5, circuit 31-LE42 (BK/OG) and C286-6, circuit 10-FA53 (GY/VT).  N0006512 • **Are the voltages between 4.7 and 5.1 volts?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** If diagnosing DTC 1261, GO to G3 . If diagnosing DTC 1259, GO to G5 .
G3 CHECK CIRCUIT 31-LE42 (BK/OG) FOR AN OPEN	

• Ignition OFF. • Measure the resistance between solar radiation sensor C286-5, circuit 31-LE42 (BK/OG) and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to G4 . **No** REPAIR circuit 31-LE42 (BK/OG) for an open. TEST the system for normal operation.
G4 CHECK CIRCUIT 8-FA53 (WH/BU) OR CIRCUIT 10-FA53 (GY/VT) FOR AN OPEN	
• Disconnect: DATC Module C228a. • Measure the resistance between DATC module C228a-7, circuit 8-FA53 (WH/BU) and solar radiation sensor C286-1, circuit 8-FA53 (WH/BU).  • Measure the resistance between DATC module C228a-20, circuit 10-FA53 (GY/VT) and solar radiation sensor C286-6, circuit 10-FA53 (GY/VT).  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR the circuit for an open. TEST the system for normal operation.
G5 CHECK CIRCUIT 8-FA53 (WH/BU) FOR A SHORT TO CIRCUIT 31-LE42 (BK/OG)	
• Ignition OFF. • Disconnect: DATC Module C228a. • Measure the resistance between solar radiation sensor C286-1, circuit 8-FA53 (WH/BU) and circuit C286-5, 31-LE42 (BK/OG).	**Yes** GO to G6 . **No** REPAIR circuit 8-FA53 (WH/BU) and 10-FA53 (GY/VT) for a short. TEST the system for normal operation.

 A0047078 • Measure the resistance between solar radiation sensor C286-6, circuit 10-FA53 (GY/VT) and circuit C286-5, 31-LE42 (BK/OG).  A0047079 • **Are the resistances greater than 10,000 ohms?**	
G6 CHECK CIRCUIT 8-FA53 (WH/BU) OR CIRCUIT 10-FA53 (GY/VT) FOR A SHORT TO GROUND	
• Measure the resistance between solar radiation sensor C286-1, circuit 8-FA53-(WH/BU) and ground.  A0015938 • Measure the resistance between solar radiation sensor C286-6, circuit 10-FA53 (GY/VT) and ground.  A0032467 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 8-FA53 (WH/BU) or 10-FA53 (GY/VT) for a short to ground. TEST the system for normal operation.

Pinpoint Test H: Insufficient, Erratic or No Heat

Normal Operation

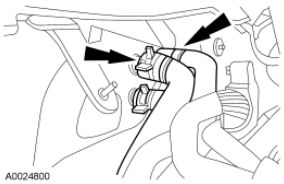
Under normal operation, the coolant control valve receives battery voltage through circuit 30-FB3 (RD/OG). The coolant control valve is provided a ground through circuit 91S-FB3 (BN/BL)/91S-FB3 (BK/OG) and/or 91S-FB4 (BN/GN) from the dual automatic temperature control (DATC) module, depending on which side of the heater core warm coolant is to flow through.

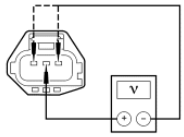
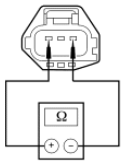
Possible Causes

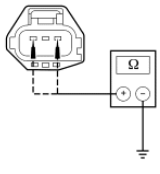
- An open in circuit 30-FB3 (RD/OG), 91S-FB3 (BN/BL), 91S-FB3 (BK/OG) or 91S-FB4 (BN/GN)
- A short to ground or voltage in circuit 91S-FB3 (BN/BL), 91S-FB3 (BK/OG) or 91S-FB4 (BN/GN)
- Coolant control valve
- DATC module
- Evaporator discharge air temperature sensor
- Thermostat

PINPOINT TEST H: INSUFFICIENT, ERRATIC OR NO HEAT

Test Step	Result / Action to Take
H1 CHECK DATC DTCs	
• Check the DATC for DTCs. • **Is DTC B2798 or B2800 present?**	**Yes** GO to H9 . **No** GO to H2 .
H2 CHECK FOR CORRECT COOLANT LEVEL	
• Ignition OFF. • Check the engine coolant level with the engine at cold and hot temperatures. • **Is the engine coolant at the correct level (both cold and hot)?**	**Yes** GO to H5 . **No** GO to H3 .
H3 CHECK THE ENGINE COOLING SYSTEM FOR LEAKS	
⚠ **WARNING: Never remove the pressure relief cap under any condition while the engine is operating. Failure to follow these instructions can result in damage to the cooling system or engine, or can result in personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap from a hot degas bottle. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When certain all the pressure has been released, use the cloth to remove the pressure relief cap.** • Fill and bleed the engine cooling system. • Pressure check the engine cooling system, including the pressure relief cap. • **Does the engine cooling system, including the pressure relief cap, hold pressure?**	**Yes** GO to H4 . **No** REPAIR the engine cooling system leak. TEST the system for normal operation.
H4 VERIFY THE FAULT WAS A LOW ENGINE COOLANT LEVEL	
NOTE: When carrying out this test step, allow time for the system to respond. • Ignition ON. • With the engine at normal operating temperature, set the DATC module driver and passenger side temperature settings to full hot and	**Yes** Test is complete. **No** GO to H5 .

note the discharge air temperature. • **Is the discharge air temperature at approximately full hot temperature setting?**	
H5 BLEED THE ENGINE COOLING SYSTEM	
⚠ **WARNING: Never remove the pressure relief cap under any condition while the engine is operating. Failure to follow these instructions can result in damage to the cooling system or engine, or can result in personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap from a hot degas bottle. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When certain all the pressure has been released, use the cloth to remove the pressure relief cap.** **NOTE:** When carrying out this test step, allow time for the system to respond. • Bleed the engine cooling system. • With the engine at normal operating temperature, set the DATC module driver and passenger side temperature settings to full hot and note the discharge air temperature. • **Is the discharge air temperature at approximately full hot temperature setting?**	**Yes** Test is complete. **No** GO to H6 .
H6 CHECK FOR HOT COOLANT AT THE HEATER CORE INLET HOSES	
⚠ **WARNING: The heater core inlet hoses will become too hot to handle and can cause serious burns if the system is working correctly. Failure to follow these instructions can result in personal injury.** • Ignition ON. • With the engine running, carefully feel both heater core inlet hoses.  • **Are both heater core inlet hoses too hot to handle?**	**Yes** CARRY OUT the heater core component test. REFER to Heater Core under Component Tests in this section to determine whether a plugged or partially plugged condition exists. **No** GO to H7 .
H7 CHECK THE COOLANT CONTROL VALVE INLET HOSE	
⚠ **WARNING: The coolant control valve inlet hose will become too hot to handle and can cause serious burns if the system is working correctly. Failure to follow these instructions can result in personal injury.**	**Yes** GO to H8 . **No** INSTALL a new thermostat. TEST the

• Carefully feel the coolant control valve inlet hose. • **Is the coolant control valve inlet hose too hot to handle?**	system for normal operation.
H8 CHECK CIRCUITS 91S-FB4 (BN/GN) AND 91S-FB3 (BN/BU)/91S-FB3 (BK/OG) FOR GROUND	
• Ignition OFF. • Disconnect: Coolant Control Valve C1034. • Ignition ON. • Set the DATC module driver and passenger side temperature settings to full hot. • Measure the voltage between coolant control valve C1034-2, circuit 30-FB3 (RD/OG) and: ♦ coolant control valve C1034-1, circuit 91S-FB4 (BN/GN). ♦ coolant control valve C1034-3, circuit 91S-FB3 (BK/OG).  A0083826 • **Is voltage present?**	**Yes** GO to H9 . **No** INSTALL a new coolant control valve. TEST the system for normal operation.
H9 CHECK CIRCUITS 91S-FB4 (BN/GN) AND 91S-FB3 (BN/BU)/91S-FB3 (BK/OG) FOR A SHORT TOGETHER	
• Ignition OFF. • Disconnect: DATC Module C228b. • Disconnect: Coolant Control Valve C1034. • Measure the resistance between coolant control valve C1034-1, circuit 91S-FB4 (BN/GN) and C1034-3, circuit 91S-FB3 (BK/OG).  A0083827 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H10 . **No** REPAIR circuit 91S-FB4 (BN/GN) for a short to circuit 91S-FB3 (BN/BU)/91S-FB3 (BK/OG). TEST the system for normal operation.
H10 CHECK CIRCUITS 91S-FB4 (BN/GN) AND 91S-FB3 (BN/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ground and: ♦ coolant control valve C1034-1, circuit 91S-FB4 (BN/GN). ♦ coolant control valve C1034-3, circuit 91S-FB3 (BN/BU).	**Yes** CARRY out the Coolant Control Valve Component Test in this section. If the valve tests OK, INSTALL a new DATC module. TEST the system for normal operation. **No**

 • **Are the resistances greater than 10,000 ohms?**	REPAIR circuit 91S-FB4 (BN/GN) or circuit 91S-FB3 (BN/BU)/91S-FB3 (BK/OG) for a short to ground. TEST the system for normal operation.

Pinpoint Test I: Insufficient Heat During Engine Idle

Normal Operation

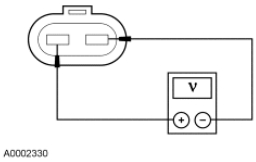
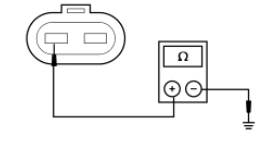
Under normal operation, the auxiliary coolant pump relay coil receives a ground from the dual automatic temperature control (DATC) module through circuit 91S-FA76 (BN/BU). The coil receives battery voltage through circuit 30-FA74 (RD/GN). Battery voltage is supplied to the relay contacts from circuit 30-FA74 (RD/GN). When the relay coil is energized, voltage is delivered to the auxiliary coolant pump motor through circuit 30S-FB1 (RD/YE). Ground for the motor is provided through circuit 31-FB1 (BK/YE).

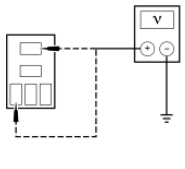
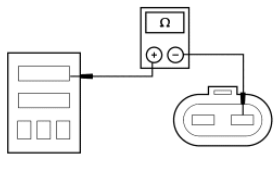
Possible Causes

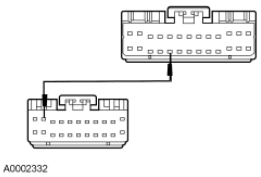
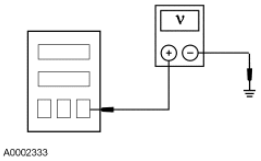
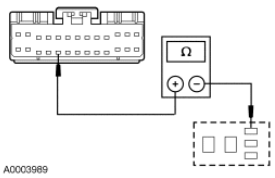
- Fuse
- An open in circuit 31-FB1 (BK/YE), 30-FA74 (RD/GN), 30S-FB1 (RD/YE) or 91S-FA76 (BN/BU)
- A short to voltage in circuit 91S-FA76 (BN/BU)
- Auxiliary coolant pump relay
- Auxiliary coolant pump motor
- DATC module

PINPOINT TEST I: INSUFFICIENT HEAT DURING ENGINE IDLE

Test Step	Result / Action to Take
I1 CARRY OUT THE DATC MODULE SELF-TEST	
• Ignition ON. • Carry out the DATC module self-test and retrieve continuous DTCs. Refer to Climate Control System . Record the DTCs displayed, if any. • **Are any DTCs displayed?**	**Yes** REFER to the DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary. **No** GO to I2 .
I2 RECHECK DATC MODULE CONFIGURATION	
• Enter Module Identification mode. • Enter the following diagnostic mode on the scan tool: PID CNFG Data. • **Does the data read 4N_3N_2Y?**	**Yes** GO to I3 . **No** RECONFIGURE the DATC module.
I3 CHECK THE COOLANT LEVEL	
• Check the coolant level with the engine at hot and cold temperatures.	**Yes** GO to I4 .

• **Is the engine coolant at the correct level (hot and cold)?**	**No** REFILL the system and PRESSURE TEST for leaks. In addition, if the coolant level had dropped below the "MIN" level, SET the system to MAX heat and RUN the engine at 3,000 rpm for 3 to 5 minutes until hot air blows from the outlets. RECHECK coolant level.GO to I4 .
I4 CHECK FOR AUXILIARY COOLANT PUMP OPERATION	
• Connect the scan tool. • Ignition ON. • In the active command mode, request Climate Control System and select Pump/VCB or set driver side temperature to 32°C (90°F). • **Can the auxiliary cooling pump be heard running or be felt running?**	**Yes** System is operating correctly. **No** GO to I5 .
I5 CHECK THE AUXILIARY PUMP MOTOR	
• Ignition OFF. • Disconnect: Auxiliary Coolant Pump C163. • Ignition ON. • Make sure the active command pump/VBC is still selected or the driver side temperature is set to 32°C (90°F). • Measure the voltage between auxiliary coolant pump C163-1, circuit 30S-FB1 (RD/YE) and C163-2, circuit 31-FB1 (BK/YE).  A0002330 • **Is the voltage greater than 10 volts?**	**Yes** INSPECT terminals for damage and correct installation. If pins are installed correctly, INSTALL a new auxiliary coolant pump. TEST the system for normal operation. **No** GO to I6 .
I6 CHECK CIRCUIT 31-FB1 (BK/YE) FOR AN OPEN	
• Measure the resistance between auxiliary coolant pump C163-2, circuit 31-FB1 (BK/YE) and ground.  A0002331	**Yes** GO to I7 . **No** REPAIR circuit 31-FB1 (BK/YE) for an open. TEST the system for normal operation.

• **Is the resistance less than 5 ohms?**	
I7 CHECK THE AUXILIARY COOLANT PUMP RELAY	
• Ignition OFF. • Disconnect: Auxiliary Coolant Pump Relay. • Measure the voltage between auxiliary coolant pump relay pins 1 and 3, circuit 30-FA74 (RD) and ground.  N0046161 • **Is the voltage greater than 10 volts?**	**Yes** GO to I8 . **No** VERIFY auxiliary junction box (AJB) fuse 1 (10A) is OK. If OK, REPAIR circuit 30-FA74 (RD) for an open. TEST the system for normal operation.
I8 CARRY OUT THE RELAY COMPONENT TEST	
• Carry out the relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the relay OK?**	**Yes** GO to I9 . **No** INSTALL a new auxiliary coolant pump relay. TEST the system for normal operation.
I9 CHECK CIRCUIT 30S-FB1 (RD/YE) FOR AN OPEN	
• Disconnect: Auxiliary Coolant Pump Relay. • Measure the resistance between auxiliary coolant pump C163-1, circuit 30S-FB1 (RD/YE) and auxiliary coolant pump relay pin 3, circuit 30S-FB1 (RD/YE).  A0002334 • **Is the resistance less than 5 ohms?**	**Yes** GO to I10 . **No** REPAIR circuit 30S-FB1 (RD/YE) for an open. TEST the system for normal operation.
I10 CHECK THE DATC MODULE	
• Ignition OFF. • Connect: Auxiliary Coolant Pump Relay. • Connect: Auxiliary Coolant Pump C163. • Disconnect: DATC Module C228a. • Disconnect: DATC Module C228b. • Connect a fused jumper wire between DATC module C228b-18, circuit 91S-FA76	**Yes** INSPECT all connectors and terminals, RECONNECT the connectors, and TEST the system for normal operation. If condition still exists, INSTALL a new DATC module. TEST the system for normal operation. **No**

(BN/BU) and DATC module C228a-2, circuit 31-FA10 (BK).  A0002332 • **Does the auxiliary coolant pump motor operate?**	GO to I11 .
I11 CHECK CIRCUIT 91S-FA76 (BN/BU) FOR A SHORT TO VOLTAGE	
NOTE: If a short to voltage is found, it is necessary to install a new DATC module. • Disconnect: Auxiliary Coolant Pump Relay. • Measure the voltage between auxiliary coolant pump relay pin 2, circuit 91S-FA76 (BN/BU) and ground.  A0002333 • **Is any voltage present?**	**Yes** REPAIR circuit 91S-FA76 (BN/BU) for a short to voltage. INSTALL a new DATC module. TEST the system for normal operation. **No** GO to I12 .
I12 CHECK CIRCUIT 91S-FA76 (BN/BU) FOR AN OPEN	
• Measure the resistance between auxiliary coolant pump relay circuit 91S-FA76 (BN/BU) and DATC module C228b-18, circuit 91S-FA76 (BN/BU).  A0003989 • **Is the resistance less than 5 ohms?**	**Yes** INSPECT all connectors and terminals, RECONNECT the connectors and TEST the system. If condition still exists, INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 91S-FA76 (BN/BU) for an open. TEST the system for normal operation.

Pinpoint Test J: Full Heat Only In All Modes

Normal Operation

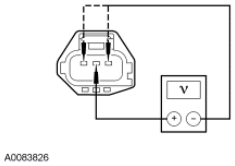
Under normal operation, the coolant control valve receives battery voltage through circuit 30-FB3 (RD/OG)/30-FA1 (RD). The coolant control valve is provided a ground through circuit 91S-FB3 (BN/BU) and/or 91S-FB4 (BN/GN) from the dual automatic temperature control (DATC) module, depending on which side of the heater core the warm coolant is to flow through.

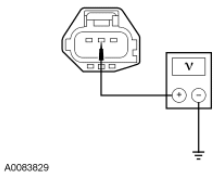
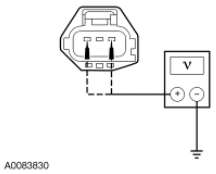
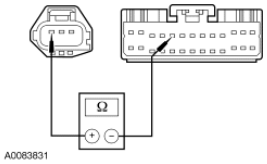
Under normal operation, the auxiliary coolant pump relay coil receives a ground from the dual automatic temperature control (DATC) module through circuit 91S-FA76 (BN/BU). The coil receives battery voltage through circuit 30-FA74 (RD/GN). Battery voltage is supplied to the relay contacts from circuit 30-FA74 (RD/GN). When the relay coil is energized, voltage is delivered to the auxiliary coolant pump motor through circuit 30S-FB1 (RD/YE). Ground for the motor is provided through circuit 31-FB1 (BK/YE).

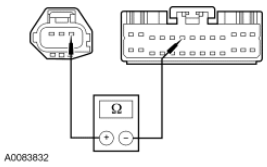
Possible Causes

- An open in circuit 30-FB3 (RD/OG)/30-FA1 (RD), 91S-FB3 (BN/BU) or 91S-FB4 (BN/GN)
- A short to ground or voltage in circuit 91S-FB3 (BN/BU) or 91S-FB4 (BN/GN)
- A short to voltage in circuit 91S-FB3 (BN/BU)/91S-FB3 (BK/OG) or 91S-FB4 (BN/GN)
- Coolant control valve
- Evaporator discharge air temperature sensor
- DATC module

PINPOINT TEST J: FULL HEAT ONLY IN ALL MODES

Test Step	Result / Action to Take
J1 CHECK DATC DTCS	
• Check the DATC for DTCs. • **Is DTC B2797 or B2799 present?**	**Yes** GO to J3 . **No** GO to J2 .
J2 CHECK CIRCUITS 91S-FB4 (BN/GN) AND 91S-FB3 (BK/OG) FOR GROUND	
• Ignition OFF. • Disconnect: Coolant Control Valve C1034. • Ignition ON. • Set the DATC module driver and passenger side temperature settings to full Cool. • Measure the voltage between coolant control valve C1034-2, circuit 30-FB3 (RD/OG) and: ♦ coolant control valve C1034-1, circuit 91S-FB4 (BN/GN). ♦ coolant control valve C1034-3, circuit 91S-FB3 (BK/OG).  A0083826	**Yes** INSTALL a new coolant control valve. TEST the system for normal operation. **No** INSTALL a new DATC module. TEST the system for normal operation.

• **Is voltage present?**	
J3 CHECK CIRCUIT 30-FB3 (RD/OG) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Coolant Control Valve C1034. • Ignition ON. • Measure the voltage between ground and coolant control valve C1034-2, circuit 30-FB3 (RD/OG).  A0083829 • **Is the voltage greater than 10 volts?**	**Yes** GO to J4 . **No** VERIFY auxiliary junction box (AJB) fuse 1 (10A) is OK. If OK, REPAIR circuit 30-FB3 (RD/OG) for an open. TEST the system for normal operation.
J4 CHECK CIRCUITS 91S-FB4 (BN/GN) AND 91S-FB3 (BN/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: DATC Module C228b. • Ignition ON. • Measure the voltage between ground and: ♦ coolant control valve C1034-1, circuit 91S-FB4 (BN/GN). ♦ coolant control valve C1034-3, circuit 91S-FB3 (BK/OG).  A0083830 • **Is voltage present?**	**Yes** REPAIR circuit 91S-FB4 (BN/GN) or 91S-FB3 (BK/OG) for a short to voltage. TEST the system for normal operation. **No** GO to J5 .
J5 CHECK CIRCUITS 91S-FB4 (BN/GN) OR 91S-FB3 (BN/BU)/91S-FB3 (BK/OG) FOR AN OPEN	
• Ignition OFF. • **NOTE:** DTC B2797 only. • Measure the resistance between coolant control valve C1034-1, circuit 91S-FB4 (BK/OG) and DATC module C228b-6, circuit 91S-FB4 (BN/GN).  A0083831	**Yes** CARRY OUT the coolant control valve component test in this section. If OK, INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 91S-FB4 (BN/GN) or 91S-FB3 (BN/BU)/91S-FB3 (BK/OG) for an open. TEST the system for normal operation.

• **NOTE:** DTC B2799 only. • Measure the resistance between coolant control valve C1034-3, circuit 91S-FB3 (BK/OG) and DATC module C228b-5, circuit 91S-FB3 (BN/BU).  • **Are the resistances less than 5 ohms?**	

Pinpoint Test K: The Dual Temperature Control Is Inoperative/Does Not Operate Correctly

Normal Operation

Under normal operation, the LH and RH discharge temperature sensors receive a ground from the dual automatic temperature control (DATC) module through circuit (LH) 9-FA47 (BN/GN)/9-FA3 (BN/RD) and (RH) 9-FA51 (BN/YE)/9-FA3 (BN/RD). A 5-volt reference voltage is supplied to the LH and RH discharge temperature sensors from the DATC module through circuits (LH) 8-FA47 (WH/GN) and (RH) 8-FA51 (WH/BK).

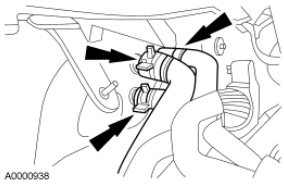
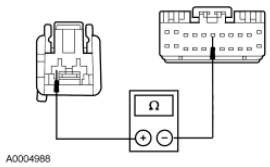
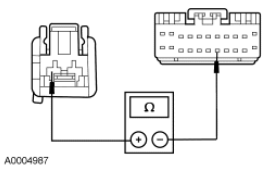
Possible Causes

- An open in circuit 9-FA47 (BN/GN) or 9-FA51 (BN/YE)
- DATC module

PINPOINT TEST K: THE DUAL TEMPERATURE CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
K1 VERIFY THE CONCERN	
NOTE: When carrying out this test step, allow time for the system to respond. • With the engine at normal operating temperature, select PANEL mode and A/C on the DATC module. • Using the driver side temperature control, set the driver side temperature to 16°C (60°F) and then set to 32°C (90°F). • **Do both the driver side and passenger side air temperatures go to full cool then to full heat?**	**Yes** GO to K2 . **No** If driver or passenger side only does not go to full cool and then full heat,GO to K6 .
K2 CHECK MODULE CONFIGURATION	
• Enter Module Identification mode. • Enter the following diagnostic mode on the scan tool: PID CNFG Data. • **Does PID CNFG data read ON and 4N_3N_2Y?**	**Yes** GO to K3 . **No** RECONFIGURE the DATC module.

K3 REQUEST CONTINUOUS CODES AND CARRY OUT THE DATC SELF-TEST	
• Request Continuous DTCs and carry out the DATC Module Self-Test. Refer to Climate Control System . Record the DTCs displayed, if any. • **Are any DTCs displayed?**	**Yes** REFER to the DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary. **No** GO to K4 .
K4 CHECK THE TEMPERATURE SENSORS FOR CORRECT INSTALLATION	
• Ignition OFF. • Check the driver side, passenger side, evaporator core and ambient air temperature sensors for correct installation. • Check the in-vehicle temperature sensor and venturi hose for correct installation. • **Are the sensors installed correctly?**	**Yes** GO to K5 . **No** CORRECT the sensor installation. TEST the system for normal operation.
K5 CHECK FOR CORRECT HEATER HOSE CONNECTIONS	
NOTE: The hose assembly that connects to the inboard port on the coolant control valve connects to the inboard port (driver side) on the heater core. • Check the heater hose connections for correct installation. • **Are the heater hoses installed correctly?**	**Yes** GO to K6 . **No** CORRECT the heater hose installation. TEST the system for normal operation.
K6 CHECK FOR CORRECT COOLANT FLOW TO THE HEATER CORE	
⚠ WARNING: The heater core inlet hoses will become too hot to handle and can cause serious burns if the system is working correctly. Failure to follow these instructions can result in personal injury. • Remove the passenger side cowl cover. • Ignition ON. • With the engine running at normal operating temperature and the DATC module set to 32°C (90°F), see if both inlet heater hoses are too hot to handle. • **Are both inlet heater hoses too hot to handle?**	**Yes** GO to K7 . **No** GO to Pinpoint Test H .
K7 CHECK CORRECT COOLANT CONTROL VALVE OPERATION	

• Remove the passenger side cowl cover. • Clamp off the 3 heater hoses going to the heater core, as close to the heater core as possible.  A0000938 • Ignition ON. • With the engine running, set the DATC module to 16°C (60°F). • **Is cooling restored?**	**Yes** Concern is with coolant control valve operation. GO to Pinpoint Test J . **No** GO to K8 .
K8 CHECK CIRCUITS 8-FA51 (WH/BK) AND 8-FA47 (WH/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Passenger Side Discharge Air Temperature Sensor C255. • Disconnect: Driver Side Discharge Air Temperature Sensor C235. • Disconnect: DATC Module C228a. • Measure the resistance between passenger side discharge air temperature sensor C255-2, circuit 8-FA51 (WH/BK) and DATC module C228a-6, circuit 8-FA51 (WH/BK).  A0004988 • Measure the resistance between driver side discharge air temperature sensor C235-2, circuit 8-FA47 (WH/GN) and DATC module C228a-18, circuit 8-FA47 (WH/GN).  A0004987 • **Are the resistances less than 5 ohms?**	**Yes** RECHECK all connections, RECONNECT and RETEST the system. If the condition still exists, INSTALL a new DATC module. TEST the system for normal operation. **No** CHECK to make sure that circuit 8-FA47 (WH/GN) is connected to DATC module C228a-6 and that circuit 8-FA51 (WH/BK) is connected to DATC module C228b-18. REPAIR as required. TEST the system for normal operation.

Pinpoint Test L: The A/C Does Not Operate/Does Not Operate Correctly

Normal Operation

Under normal operation, when the powertrain control module (PCM) receives an A/C request signal from the DATC module, the PCM provides a ground for the A/C clutch relay coil through circuit 91S-FA79 (BN/BL). The A/C clutch relay coil receives ignition voltage through circuit 15S-FA79 (GN/RD). The relay switch receives battery voltage through circuit 30-FA79 (RD/OG). When the relay coil is grounded, voltage is delivered through circuit 15-FA6 (GN/YE) to the A/C compressor clutch field coil. Ground for the A/C compressor clutch field coil is provided through circuit 31-FA6 (BK/YE).

Possible Causes

- Fuse(s)
- An open in circuit 31-FA6 (BK/YE), 30-FA79 (RD/OG), 91S-FA79 (BN/BL), 15S-FA79 (GN/RD) or 15-FA6 (GN/YE)
- A short to voltage in circuit 91S-FA79 (BN/BL)
- A/C clutch relay
- A/C compressor clutch/field coil
- DATC module
- Evaporator discharge air temperature sensor
- PCM

PINPOINT TEST L: THE A/C DOES NOT OPERATE/DOES NOT OPERATE CORRECTLY

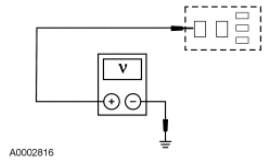
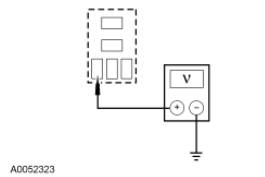
NOTE: The ambient temperature must be above 0°C (32°F) to permit the A/C compressor to operate.

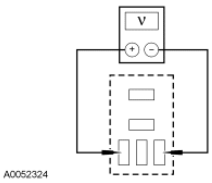
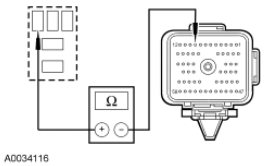
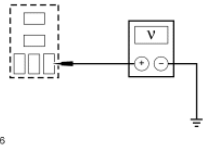
NOTE: Before carrying out the following test, diagnose any PCM DTCs.

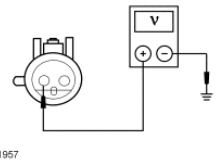
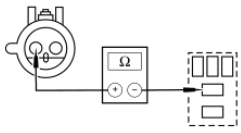
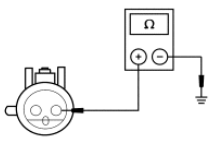
NOTE: Before carrying out the following test, make sure that the A/C system pressure is above 290 kPa (42 psi). If the pressure is below 290 kPa (42 psi), refer to Fluorescent Dye Leak Detection in this section.

Test Step	Result / Action to Take
L1 CHECK THE A/C PRESSURE PCM PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: A/C Pressure PCM PID. • With the manifold gauge set connected, compare the pressure readings of the manifold gauge set and the A/C pressure PID. • **Are the pressure values of the manifold gauge set and the A/C pressure PID similar?**	**Yes** GO to L2 . **No** INSTALL a new A/C pressure transducer. TEST the system for normal operation.
L2 CHECK THE A/C EVAPORATOR TEMPERATURE PID	
• Allow the vehicle exterior and interior to stabilize to an ambient temperature above 16°C (60°F). • Enter the following diagnostic mode on the scan tool: A/C Evaporator Discharge Temperature PCM PID.	**Yes** GO to L3 . **No** INSTALL a new A/C evaporator discharge temperature sensor. TEST the system for normal operation.

• **Does the A/C evaporator discharge temperature PID read similar to the ambient temperature?**	
L3 VERIFY CUSTOMER COMPLAINT	
• Make sure the engine is at operating temperature. • Select panel and A/C modes. • **Is full heat present in all temperature settings?**	**Yes** GO to Pinpoint Test J . **No** GO to L4 .
L4 CARRY OUT THE PCM AND DATC MODULE SELF-TESTS	
• Enter the following diagnostic mode on the scan tool: PCM Self Test. • Ignition ON. • Carry out the PCM self-test. Record any DTCs displayed. • Carry out the DATC module self-test and retrieve continuous DTCs. Refer to Climate Control System . Record the DTCs displayed, if any. • **Were any DTCs displayed?**	**Yes** REFER to the PCM or DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary. **No** GO to L5 .
L5 CHECK PID WACF WITH THE A/C ON	
NOTE: When PCM PID WACF is YES, this is the same fault as DTC P1460. • Ignition ON. • With the engine running, press the DATC PANEL and A/C override button. Make sure the A/C indicator LED is on. • Enter the following diagnostic mode on the scan tool: PCM PID WACF. • **Does the PCM PID WACF read YES?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue the diagnosis. **No** GO to L6 .
L6 CHECK PID ACCS WITH THE A/C ON	
• Make sure PID EXT_FT2 reading is greater than 0°C (32°F). • Make sure that the PID ACPEVAP reading is greater than 2°C (35°F). • Make sure the engine is at idle. • Press the DATC PANEL and the A/C override buttons. Make sure the A/C indicator LED is on. • Enter the following diagnostic mode on the scan tool: PCM PID ACCS. • **Does the PCM PID ACCS read ON?**	**Yes** GO to L7 . **No** INSTALL a new DATC module. TEST the system for normal operation.
L7 CHECK PID WAC WITH THE A/C ON	
• Press the DATC PANEL and the A/C override button. Make sure the A/C	**Yes** GO to L8 .

indicator LED is on. • Enter the following diagnostic mode on the scan tool: PCM PID WAC. • **Does the PID WAC read ON?**	**No** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue the diagnosis.
L8 CHECK THE REFRIGERANT SYSTEM PRESSURE	
• Ignition OFF. • Connect the manifold set to the service ports. Refer to Manifold Gauge Set Connection in this section. • **Is the pressure between 345 kPa (50 psi) and 1,724 kPa (250 psi)?**	**Yes** GO to L9 . **No** CHECK the system for refrigerant system leaks. REPAIR as necessary. TEST the system for normal operation.
L9 CHECK FOR VOLTAGE TO THE A/C RELAY	
• Ignition OFF. • Disconnect: A/C Clutch Relay. • Ignition ON. • Measure the voltage between A/C clutch relay pin 3, circuit 30-FA79 (RD/OG) and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to L10 . **No** VERIFY auxiliary junction box (AJB) fuse 1 (10A) is OK. If OK, REPAIR circuit 30-FA79 (RD/OG) for an open. TEST the system for normal operation.
L10 CHECK CIRCUIT 15S-FA79 (GN/RD) FOR VOLTAGE	
• Measure the voltage between A/C clutch relay pin 1, circuit 15S-FA79 (GN/RD) and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to L11 . **No** VERIFY auxiliary junction box (AJB) fuse 11 (15A) is OK. If OK, REPAIR circuit 15S-FA79 (GN/RD) for an open. TEST the system for normal operation.
L11 CHECK DATC MODULE OUTPUT	

• Press the DEFROST override button on the DATC module. • Measure the voltage between A/C clutch relay pin 1, circuit 15S-FA79 (GN/RD) and pin 2, circuit 91S-FA79 (BN/BU).  A0052324 • **Is the voltage greater than 10 volts?**	**Yes** GO to L14 . **No** GO to L12 .
L12 CHECK CIRCUIT 91S-FA79 (BN/BU) FOR AN OPEN	
• Ignition OFF. • Disconnect: PCM C175B. • Measure the resistance between A/C clutch relay pin 2, circuit 91S-FA79 (BN/BU) and PCM C175B-9 circuit 91S-FA79 (BN/BU).  A0034116 • **Is the resistance less than 5 ohms?**	**Yes** GO to L13 . **No** REPAIR circuit 91S-FA79 (BN/BU) for an open. TEST the system for normal operation.
L13 CHECK CIRCUIT 91S-FA79 (BN/BU) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between A/C clutch relay socket pin 2, circuit 91S-FA79 (BN/BU) and the ground.  A0055256 • **Is voltage present?**	**Yes** REPAIR circuit 91S-FA79 (BN/BU) for a short to voltage. TEST the system for normal operation. **No** INSTALL a new PCM. TEST the system for normal operation.
L14 CHECK THE A/C CLUTCH INPUT	

• Ignition OFF. • Connect: A/C Clutch Relay. • Disconnect: A/C Clutch Field Coil C100. • Ignition ON. • With the engine running, measure the voltage between A/C clutch field coil C100-2, circuit 15S-FA6 (GN/YE) and ground.  A0001957 • **Is the voltage greater than 10 volts?**	**Yes** GO to L16 . **No** GO to L15 .
L15 CHECK CIRCUIT 15S-FA6 (GN/YE) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between A/C clutch C100-2, circuit 15S-FA6 (GN/YE) and A/C clutch relay pin 5, circuit 15S-FA6 (GN/YE).  A0056515 • **Is the resistance 5 ohms or less?**	**Yes** INSTALL a new A/C clutch relay. TEST the system for normal operation. **No** REPAIR circuit 15S-FA6 (GN/YE) for an open. TEST the system for normal operation.
L16 CHECK THE A/C CLUTCH GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Measure the resistance between A/C clutch C100-1, circuit 31-FA6 (BK/YE) and ground.  A0001959 • **Is the resistance 5 ohms or less?**	**Yes** GO to L17 . **No** REPAIR circuit 31-FA6 (BK/YE) for an open. TEST the system for normal operation.
L17 CHECK THE CLUTCH AIR GAP	

• Measure the A/C compressor clutch air gap at 3 equally spaced locations between the clutch hub and the A/C compressor clutch pulley. • **Is the A/C compressor clutch air gap greater than 0.75 mm (0.030 in)?**	**Yes** ADJUST the A/C compressor clutch field coil. TEST the system for normal operation. **No** INSTALL a new A/C compressor clutch field coil. TEST the system for normal operation.

Pinpoint Test M: The Air Conditioning (A/C) Is Always On

Normal Operation

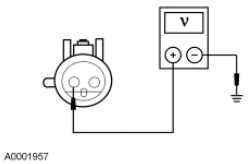
Under normal operation, when the powertrain control module (PCM) receives an A/C request signal from the DATC module, the PCM provides a ground for the A/C clutch relay coil through circuit 91S-FA79 (BN/BL). The A/C clutch relay coil receives ignition voltage through circuit 15S-FA79 (GN/RD). The relay switch receives battery voltage through circuit 30-FA79 (RD/OG). When the relay coil is grounded, voltage is delivered through circuit 15-FA6 (GN/YE) to the A/C compressor clutch field coil. Ground for the A/C compressor clutch field coil is provided through circuit 31-FA6 (BK/YE).

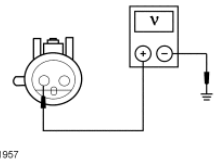
Possible Causes

- A short to voltage in circuit 15-FA6 (GN/YE)
- A/C clutch relay
- A/C compressor clutch/field coil
- DATC module
- PCM

PINPOINT TEST M: THE A/C IS ALWAYS ON

Test Step	Result / Action to Take
M1 CARRY OUT THE PCM AND DATC MODULE SELF-TESTS	
• Enter the following diagnostic mode on the scan tool: PCM Self Test. • Ignition ON. • Carry out the PCM self-test. Record any DTCs. • Carry out the DATC module self-test and retrieve continuous DTCs. Refer to Climate Control System under Diagnosis and Testing in this section. Record the DTCs displayed, if any. • **Are any PCM or DATC DTCs displayed?**	**Yes** REFER to the PCM or DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary. **No** GO to M2 .
M2 CHECK DATC BUTTONS	
• With the engine running, toggle between DATC OFF button and the A/C button. • **DOES the A/C indicator light turn on when the A/C button is pushed, and off when the OFF button is pushed?**	**Yes** GO to M3 . **No** INSTALL a new DATC module. TEST the system for normal operation.
M3 CHECK PCM PID ACCS	

• Enter the following diagnostic mode on the scan tool: PCM PID ACCS. • Ignition ON. • Push the DATC OFF button, then push the A/C button. • **Does the A/C indicator light turn off and on and the PCM PID ACCS continue to read ON?**	**Yes** RERUN the Data Link Diagnostic Test. **No** GO to M4 .
M4 CHECK PID WACF WITH THE A/C OFF	
• Ignition ON. • Push the DATC OFF button. • Enter the following diagnostic mode on the scan tool: PCM PID WACF. • **Does PCM PID WACF read YES?**	**Yes** REPAIR circuit 91S-FA79 (BK/OG) for a short to ground. TEST the system for normal operation. **No** GO to M5 .
M5 CHECK CIRCUIT 15S-FA6 (GN/YE) FOR VOLTAGE	
• Ignition OFF. • Disconnect: A/C Clutch C100. • Ignition ON. • Make sure the DATC is in the OFF position. • Measure the voltage between A/C clutch field coil C100-2, circuit 15S-FA6 (GN/YE) and ground.  A0001957 • **Is the voltage greater than 10 volts?**	**Yes** GO to M7 . **No** GO to M6 .
M6 CHECK THE CLUTCH AIR GAP	
• Measure the A/C compressor clutch air gap at 3 equally spaced locations between the clutch hub and the A/C compressor clutch pulley. • **Is the A/C compressor clutch air gap greater than 0.75 mm (0.030 in)?**	**Yes** ADJUST the A/C compressor clutch field coil. TEST the system for normal operation. **No** INSTALL a new A/C compressor clutch field coil. TEST the system for normal operation.
M7 CHECK CIRCUIT 15-FA6 (GN/YE) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: A/C Clutch Relay. • Ignition ON. • With the engine running, measure the voltage between A/C clutch field coil C100-2, circuit 15S-FA6 (GN/YE) and ground.	**Yes** REPAIR circuit 15S-FA6 (GN/YE) for a short to voltage. TEST the system for normal operation. **No** INSTALL a new A/C clutch relay. TEST the system for normal operation.

 • **Is the voltage greater than 10 volts?**	

Pinpoint Test N: The Blower Motor Is Inoperative

Normal Operation

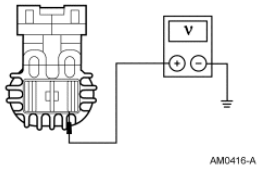
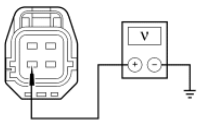
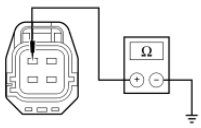
Under normal operation, the blower motor relay coil receives a ground from the DATC module through circuit 31S-FA23 (BK/BU). The coil receives voltage through circuit 30-FA24 (RD/OG). Voltage is supplied to the relay contacts from circuit 30-FA24 (RD/OG). When the relay coil is energized, voltage is delivered to the blower motor through circuit 30S-FA18 (RD/BK). Ground for the motor is provided through circuit 31S-FA18 (BK/RD) from the blower control module. Ground for the blower control module is provided by circuit 31-FA45 (BK). The DATC module sends a 0-volt (LO) to 5-volt (HI) signal to the blower control module through circuit 8-FA45 (WH/BU) to control the blower speed.

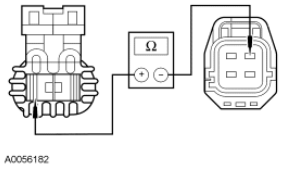
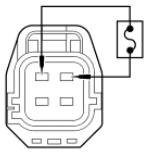
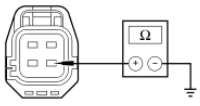
Possible Causes

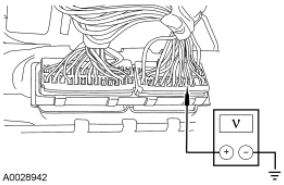
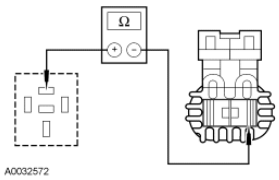
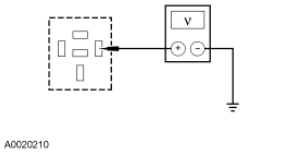
- Fuse
- An open in circuit 31-FA45 (BK), 31S-FA18 (BK/RD), 30S-FA18 (RD/BK), 30-FA24 (RD/OG) or 31S-FA23 (BK/BU)
- A short to ground in circuit 8-FA45 (WH/BU)
- A short to voltage in circuit 31S-FA23 (BK/BU)
- A/C blower relay
- Blower motor control module
- DATC module

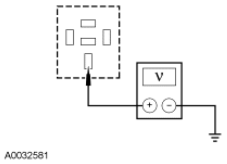
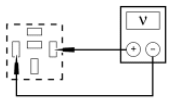
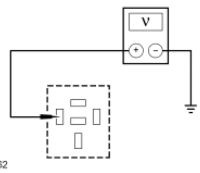
PINPOINT TEST N: THE BLOWER MOTOR IS INOPERATIVE

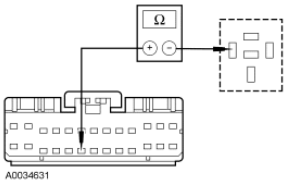
Test Step	Result / Action to Take
N1 VERIFY THE BLOWER MOTOR OPERATION	
• Ignition ON. • Press the PANEL button on the DATC module. Adjust the blower motor setting to LO and then to HI. • **Is the blower motor inoperative in all settings?**	**Yes** GO to N2 . **No** GO to Pinpoint Test O .
N2 CHECK FOR VOLTAGE TO THE BLOWER MOTOR	
• Ignition OFF. • Disconnect: Blower Motor C288. • Ignition ON.	**Yes** GO to N3 . **No** GO to N9 .

• Measure the voltage between blower motor C288-1, circuit 30S-FA18 (RD/BK) and ground.  AM0416-A • **Is the voltage greater than 10 volts?**	
N3 CHECK FOR VOLTAGE TO THE BLOWER MOTOR CONTROLLER	
• Ignition OFF. • Disconnect: Blower Motor Speed Control C297. • Ignition ON. • Measure the voltage between blower motor speed control C297-4, circuit 30S-FA45 (RD/OG) and ground.  A0052329 • **Is the voltage greater than 10 volts?**	**Yes** GO to N4 . **No** REPAIR circuit 30S-FA45 (RD/OG) for an open. TEST the system for normal operation.
N4 CHECK CIRCUIT 31-FA45 (BK) FOR AN OPEN	
• Measure the resistance between blower motor speed control C297-2, circuit 31-FA45 (BK) and ground.  A0056181 • **Is the resistance less than 5 ohms?**	**Yes** GO to N5 . **No** REPAIR circuit 31-FA45 (BK) for an open. TEST the system for normal operation.
N5 CHECK CIRCUIT 31S-FA18 (BK/RD) FOR AN OPEN	

• Measure the resistance between blower motor C288-2, circuit 31S-FA18 (BK/RD) and blower motor speed control C197-1, circuit 31S-FA18 (BK/RD).  A0056182 • **Is the resistance less than 5 ohms?**	**Yes** GO to N6 . **No** REPAIR circuit 31S-FA18 (BK/RD) for an open. TEST the system for normal operation.
N6 CHECK THE BLOWER MOTOR	
• Connect: Blower Motor C288. • Connect a fused jumper lead between blower motor speed control C197-1, circuit 31S-FA18 (BK/RD) and C197-2, circuit 31-FA45 (BK).  A0056183 • Ignition ON. • **Does the blower motor operate?**	**Yes** GO to N7 . **No** INSTALL a new blower motor. TEST the system for normal operation.
N7 CHECK CIRCUIT 8-FA45 (WH/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Remove the fused jumper lead from blower motor speed control C297. • Disconnect: DATC Module C228b. • Measure the resistance between blower motor speed control C197-3, circuit 8-FA45 (WH/BU) and ground.  A0052330 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to N8 . **No** REPAIR circuit 8-FA45 (WH/BU) for a short to ground. TEST the system for normal operation.
N8 CHECK THE DATC MODULE OUTPUT	

• Connect: DATC Module C228b. • Connect: Blower Motor Speed Control C297. • Ignition ON. • Adjust the blower motor speed to HI (7 bars). • Measure the voltage between DATC module C228a-15, circuit 8-FA45 (WH/BU) and ground by back-probing the DATC module C228a.  • **Is the voltage greater than 4.5 volts?**	**Yes** INSTALL a new blower motor speed control. TEST the system for normal operation. **No** INSTALL a new DATC module. TEST the system for normal operation.
N9 CHECK CIRCUIT 30S-FA18 (RD/BK) FOR AN OPEN	
• Ignition OFF. • Disconnect: Blower Motor Relay. • Measure the resistance between blower motor relay pin 87, circuit 30S-FA18 (RD/BK) and blower motor C288-1, circuit 30S-FA18 (RD/BK).  • **Is the resistance less than 5 ohms?**	**Yes** GO to N10 . **No** REPAIR circuit 30S-FA18 (RD/BK) for an open. TEST the system for normal operation.
N10 CHECK CIRCUIT 30-FA24A (RD/OG) FOR AN OPEN	
• Measure the voltage between blower motor relay pin 86, circuit 30-FA24A (RD/OG) and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to N11 . **No** VERIFY auxiliary junction box (AJB) fuse 16 (30A) is OK. If OK, REPAIR circuit 30-FA24A (RD/OG) for an open. TEST the system for normal operation.
N11 CHECK CIRCUIT 30-FA24 (RD/OG) FOR AN OPEN	

• Measure the voltage between blower motor relay pin 30, circuit 30-FA24 (RD/OG) and ground.  A0032581 • **Is the voltage greater than 10 volts?**	**Yes** GO to N12 . **No** VERIFY auxiliary junction box (AJB) fuse 16 (30A) is OK. If OK, REPAIR circuit 30-FA24 (RD/OG) for an open. TEST the system for normal operation.
N12 CHECK THE DATC MODULE OUTPUT	
• Ignition ON. • Measure the voltage between blower motor relay pin 86, circuit 30-FA24A (RD/OG) and pin 85, circuit 31S-FA23 (BK/BU).  A0034149 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new blower motor relay. TEST the system for normal operation. **No** GO to N13 .
N13 CHECK CIRCUIT 31S-FA23 (BK/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: DATC Module C228b. • Ignition ON. • Measure the voltage between blower motor relay pin 85, circuit 31S-FA23 (BK/BU) and ground.  A0013862 • **Is voltage present?**	**Yes** REPAIR circuit 31S-FA23 (BK/BU) for a short to voltage. TEST the system for normal operation. **No** GO to N14 .
N14 CHECK CIRCUIT 31S-FA23 (BK/BU) FOR AN OPEN	

• Measure the resistance between DATC module C228b-19, circuit 31S-FA23 (BK/BU) and blower motor relay pin 85, circuit 31S-FA23 (BK/BU).  A0034631 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 31S-FA23 (BK/BU) for an open. TEST the system for normal operation.

Pinpoint Test O: The Blower Motor Does Not Operate Correctly

Normal Operation

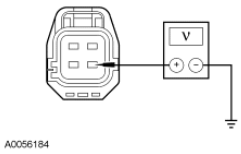
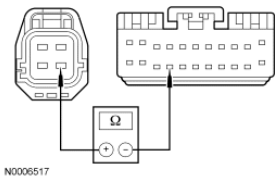
Under normal operation, the blower motor relay coil receives a ground from the DATC module through circuit 31S-FA23 (BK/BU). The coil receives voltage through circuit 30-FA24 (RD/OG). Voltage is supplied to the relay contacts from circuit 30-FA24 (RD/OG). When the relay coil is energized, voltage is delivered to the blower motor through circuit 30S-FA18 (RD/BK). Ground for the motor is provided through circuit 31S-FA18 (BK/RD) from the blower control module. Ground for the blower control module is provided by circuit 31-FA45 (BK). The DATC module sends a 0-volt (LO) to 5-volt (HI) signal to the blower control module through circuit 8-FA45 (WH/BU) to control the blower speed.

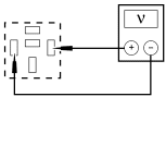
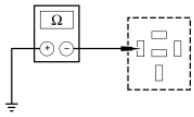
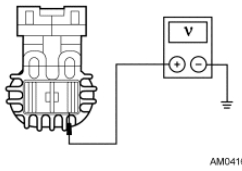
Possible Causes

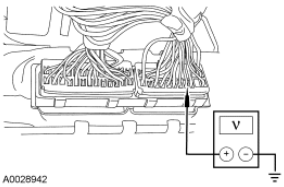
- An open in circuit 8-FA45 (WH/BU)
- A short to ground in circuit 31S-FA18 (BK/RD) or 31S-FA23 (BK/BU)
- A short to voltage in circuit 8-FA45 (WH/BU) or 30S-FA18 (RD/BK)
- Blower motor control module
- DATC module

PINPOINT TEST O: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
O1 VERIFY THE BLOWER MOTOR OPERATION	
• Ignition ON. • Press the PANEL button on the DATC module. Adjust the blower motor setting to LO and then to HI. • **Does the blower motor operate at any setting?**	**Yes** If the blower motor operates always in HIGH, GO to O2 . If the blower motor is always ON, GO to O5 . **No** GO to Pinpoint Test N .
O2 CHECK CIRCUIT 31S-FA18 (BK/RD) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Blower Motor Speed Control C297.	**Yes** REPAIR circuit 31S-FA18 (BK/RD) for a short to ground.

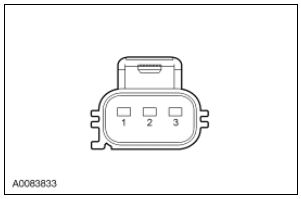
• Ignition ON. • **Does the blower motor operate?**	TEST the system for normal operation. **No** GO to O3 .
O3 CHECK CIRCUIT 8-FA45 (WH/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: DATC Module C228a. • Ignition ON. • Measure the voltage between blower motor speed control C197-3, circuit 8-FA45 (WH/BU) and ground.  A0056184 • **Is voltage present?**	**Yes** REPAIR circuit 8-FA45 (WH/BU) for a short to voltage. TEST the system for normal operation. **No** GO to O4 .
O4 CHECK CIRCUIT 8-FA45 (WH/BU) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between blower motor speed control C197-3, circuit 8-FA45 (WH/BU) and DATC Module C228a-15, circuit 8-FA45 (WH/BU).  N0006517 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new blower motor speed control. TEST the system for normal operation. **No** REPAIR circuit 8-FA45 (WH/BU) for an open. TEST the system for normal operation.
O5 CHECK THE DATC MODULE OUTPUT	
• Ignition OFF. • Disconnect: Blower Motor Relay. • Ignition ON. • Measure the voltage between blower motor relay pin 86, circuit 30-FA24A (RD/OG) and socket pin 85, circuit 31S-FA23 (BK/BU).	**Yes** GO to O6 . **No** GO to O7 .

 A0034149 • **Is the voltage greater than 10 volts?**	
O6 CHECK CIRCUIT 31S-FA23 (BK/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: DATC Module C228a. • Measure the resistance between blower motor relay pin 85, circuit 31S-FA23 (BK/BU) and ground.  A0013869 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new DATC module. TEST the system for normal operation. **No** REPAIR circuit 31S-FA23 (BK/BU) for a short to ground. TEST the system for normal operation.
O7 CHECK CIRCUIT 30S-FA18 (RD/BK) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Blower Motor C288. • Ignition ON. • Measure the voltage between blower motor C288-1, circuit 30S-FA18 (RD/BK) and ground.  AM0416-A • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit 30S-FA18 (RD/BK) for a short to voltage. TEST the system for normal operation. **No** GO to O8 .
O8 CHECK THE DATC MODULE BLOWER CONTROL OUTPUT	
• Adjust the blower motor speed to LO (1 bar). • Measure the voltage between DATC module C228a-15, circuit 8-FA45 (WH/BU) and ground by back-probing DATC module C228a.	**Yes** INSTALL a new blower motor speed control. TEST the system for normal operation. **No** INSTALL a new DATC module. TEST the system for normal operation.

 • **Is the voltage less than 1 volt?**	

Component Tests

Coolant Control Valve



Coolant Control Valve Pins	Resistance
1 and 2	10-23 ohms
2 and 3	10-23 ohms

Heater Core

⚠ WARNING: Carbon monoxide is colorless, odorless and dangerous. If it is necessary to operate the engine with the vehicle in a closed area such as a garage, always use an exhaust collector to vent the exhaust gases outside the closed area.

1. **NOTE:** Testing of returned heater cores reveals that a large percentage of heater cores are good and did not require the installation of a new heater core. If a heater core leak is suspected, the heater core must be tested by following the plugged heater core component test before the heater core pressure test. Carry out a system inspection by checking the heater system thoroughly as follows:

   Inspect for evidence of coolant leakage at the heater hose to heater core attachments. A coolant leak in the heater hose could follow the heater core tube to the heater core and appear as a leak in the heater core.

2. **NOTE:** Spring-type clamps are installed as original equipment. Installation and overtightening of non-specified clamps can cause leakage at the heater hose connection and damage the heater core.

   Check the integrity of the heater hose clamps.

Heater Core — Plugged

⚠ WARNING: The heater core inlet hose will become too hot to handle if the system is working correctly.

1. Check to see that the engine coolant is at the correct level.

2. Start the engine and turn ON the heater.

3. When the engine coolant reaches operating temperature, feel the heater core inlet and outlet hoses to see if they are hot.

4. If the outlet only is not hot:
   - the heater core may have an air pocket.
   - the heater core may be plugged.

5. If the inlet only is not hot:
   - the thermostat may not be working correctly.
   - the coolant control valve may not be working correctly.

Heater Core — Pressure Test

Use the Pressure Test Kit to carry out the pressure test.

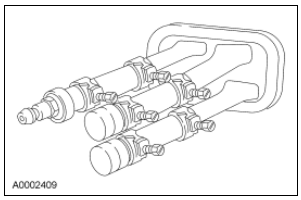
1. **NOTE:** Due to space limitations, a bench test may be necessary for pressure testing.

   Drain the coolant from the cooling system.

2. Disconnect the heater hoses from the heater core.

3. Install a short piece of heater hose, approximately 101 mm (4 inch) long on each heater core tube.

4. Fill the heater core and heater hoses with water and install the 2 plugs BT-7422-B and the adapter BT-7422-A from the Pressure Test Kit. Secure the heater hoses, plug and adapter with hose clamps.



5. Attach the pump and gauge assembly from the Pressure Test Kit to the adapter.

6. Close the bleed valve at the base of the gauge. Pump 138 kPa (20 psi) of air pressure into the heater core.

7. Observe the pressure gauge for a minimum of 3 minutes.

8. If the pressure drops, check the heater hose connections to the core tubes for leaks. If the heater hoses do not leak, remove the heater core from the vehicle and carry out the bench test.

Heater Core — Bench Test

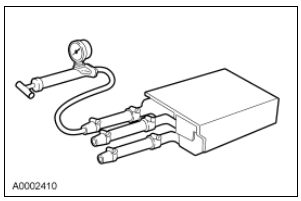
1. Remove the heater core from the vehicle.

2. Drain all of the coolant from the heater core.

3. Connect the 101 mm (4 inch) test heater hoses with plug and adapter to the core tubes. Then connect the Pressure Test Kit to the adapter.

4. Apply 138 kPa (20 psi) of air pressure to the heater core. Submerge the heater core in water.

5. If a leak is observed, install a new heater core.



Evaporator/Condenser Core — On-Vehicle Leak Test

1. Discharge and recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

2. Disconnect the suspect evaporator core or condenser core from the A/C system.

3. Clean the manifold fittings.

4. Connect the appropriate test fittings from the Set, A/C Fittings to the condenser core tube connections.

5. Connect the Vacuum Check Fitting, TXV to the thermostatic expansion valve.

6. **NOTE:** The automatic shut-off valves on some gauge set hoses do not open when connected to the test fittings. If available, use hoses without shut-off valves. If hoses with shut-off valves are used, make sure the valve opens when attached to the test fittings or install an adapter that will activate the valve. The test is not valid if the shut-off valve does not open.

   Connect the red and blue hoses from the R-134a Manifold Gauge Set to the test fittings on the evaporator core or condenser core. Connect the yellow hose to a known good vacuum pump.

7. Open both gauge set valves and start the vacuum pump. Allow the vacuum pump to operate for a minimum of 45 minutes after the gauge set low pressure gauge indicates 101 kPa (30 in-Hg). The 45-minute evacuation is necessary to remove any refrigerant from oil left in the evaporator core or condenser core. If the refrigerant is not completely removed from the oil, outgassing will degrade the vacuum and appear as a refrigerant leak.

8. If the low pressure gauge reading will not drop to 101 kPa (30 in-Hg) when the valves on the gauge and manifold set are open and the vacuum pump is operating, close the gauge set valves and observe the low pressure gauge. If the pressure rises rapidly to zero, a large leak is indicated. Recheck the test fitting connections and gauge set connections before installing a new evaporator core or condenser core.

9. After evacuating for 45 minutes, close the gauge set valves and stop the vacuum pump. Observe the low pressure gauge; it should remain at the 101 kPa (30 in-Hg) mark.
   - If the low pressure gauge reading rises 34 or more kPa (10 or more in-Hg) of vacuum from the 101 kPa (30 in-Hg) position in 10 minutes, a leak is indicated.
   - If a very small leak is suspected, wait 30 minutes and observe the vacuum gauge.
   - If a small amount of vacuum is lost, operate the vacuum pump with gauge valves open for an additional 30 minutes to remove any remaining refrigerant from the oil in the evaporator core or condenser core. Then recheck for loss of vacuum.
   - If a very small leak is suspected, allow the system to sit overnight with vacuum applied and check for vacuum loss.

10. If the evaporator core or condenser core does leak, as verified by the above procedure, install a new evaporator core or condenser core.

A/C Compressor — External Leak Test

1. Install the A/C Pressure Test Adapter on the port of the A/C compressor, using the existing manifold retaining bolt.

2. Connect the high and low pressure lines of a manifold gauge set or a refrigerant recovery/recycling station such as the R-134a A/C service center to the corresponding fittings on the A/C Pressure Test Adapter.

3. Attach the center hose of a manifold gauge set to a refrigerant container standing in an upright position.

4. Hand-rotate the compressor shaft 10 complete revolutions to distribute the oil inside the A/C compressor.

5. Open the low pressure gauge valve, the high pressure gauge valve and the valve on the refrigerant container to allow the refrigerant vapor to flow into the A/C compressor.

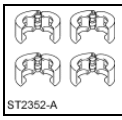
6. Using the Refrigerant Leak Detector, check for leaks at the compressor shaft.

7. If a shaft or external leak is found, install a new A/C compressor.

8. When the leak test is complete, recover the refrigerant from the compressor.

Spring Lock Coupling

Special Tool(s)

 ST2352-A	Remover, Refrigerant Coupling Spring 412-039 (T84L-19623-B)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

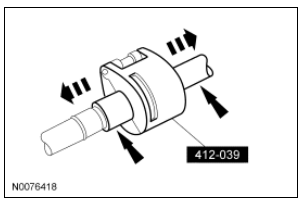
Disconnect

NOTE: If a leak has been found at a spring lock coupling, inspect the O-ring sealing surfaces on the male and female sides of the fitting for damage or scratches. Replace the affected component if damage is identified. If no damage is present, thoroughly clean both sides of the fitting using a suitable non-abrasive cloth, lubricate with PAG oil and install new O-ring seals. Due to subtle differences in O-ring sizes, it is critical for leak prevention that the correct O-ring seal be identified. Refer to the Ford Catalog Advantage™ or equivalent for the specific vehicle and application. When repairs are complete, leak test the spring lock coupling to verify the repair.

1. Remove the spring lock coupling clip, if equipped.
2. ***NOTICE:*** **Do not use metal tools to remove the O-ring seals. They may cause axial scratches across the O-ring seal grooves, resulting in refrigerant leaks.**

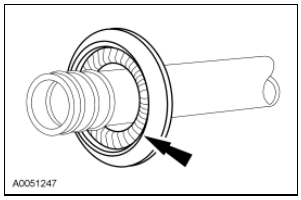
   Push the Refrigerant Coupling Spring Remover into the cage opening to release the female fitting from the spring lock coupling spring and pull the fitting apart.

   - Remove the O-ring seals using a non-metallic tool.



3. ***NOTICE:*** **Do not use a screwdriver or similar tool to remove the Air Conditioning (A/C) tube lock coupling spring; this may cause axial scratches across the O-ring seal grooves resulting in refrigerant leaks.**

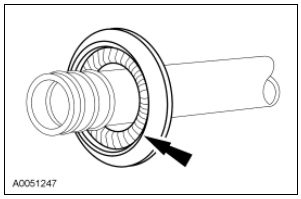
   Remove the spring lock coupling spring with a small hooked wire.



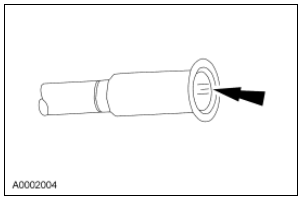
Connect

NOTICE: **It is imperative that the sealing surface of the spring lock coupling and O-ring seal be clean and completely free from debris. To prevent contamination, only new PAG oil should be used as an O-ring seal lubricant. Contamination from used PAG oil, residual PAG oil from inside the refrigerant system or a failure to thoroughly clean the fitting sealing surface will interrupt the O-ring seal-to-fitting sealing surface and cause refrigerant system leaks.**

1. Install the spring lock coupling spring.

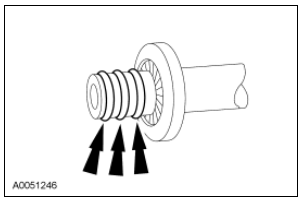


2. Lubricate the inside of the coupling with PAG oil.

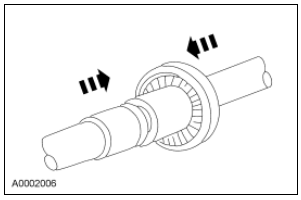


3. ***NOTICE:*** **Use only the new O-ring seals. The use of any O-ring seals other than those specified in the Ford Catalog Advantage™ or equivalent may result in intermittent leakage during vehicle operation.**

   Install the O-ring seals.



4. Connect the spring lock coupling fittings with a twisting motion until the spring lock coupling spring snaps over the flared end of the female fitting.



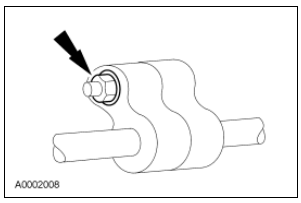
5. Install the spring lock coupling clip.

Air Conditioning Line (Peanut) Fitting

Disconnect

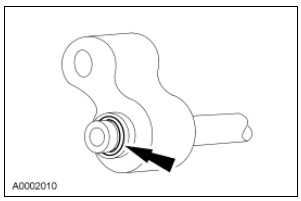
1. ***NOTICE:*** **Support the female fitting with a wrench to prevent the tubes from twisting.**

   Remove the nut and separate the 2 halves of the peanut fitting.



2. ***NOTICE:*** **Do not use metal tools to remove the O-ring seal. They can cause axial scratches across the O-ring seal groove, resulting in refrigerant leaks.**

   Remove the O-ring seal with a non-metallic tool.

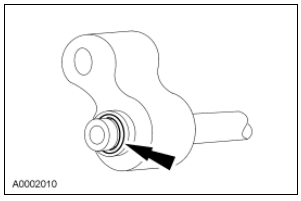


Connect

1. Clean all dirt or foreign material from the fittings.

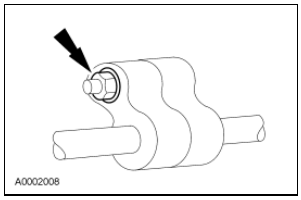
2. ***NOTICE:*** **Use only the new O-ring seals. The use of any O-ring seals other than those specified in the Ford Catalog Advantage ™ or equivalent may result in intermittent leakage during vehicle operation.**

   Install the O-ring seal.



3. **NOTE:** When correctly assembled, the male and female fittings should be flush.

   Assemble the male and female fittings together.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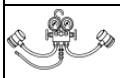
Refrigerant System Tests

Special Tool(s)

ST2738-A	R-134a Refrigerant Center 176-00002 or equivalent
ST2739A	R-134a Refrigerant Center 023-00174 or equivalent
 ST1928-A	R-134a Manifold Gauge Set 023-00047 or equivalent

Procedure 1 — Ambient Temperature At or Below 38°C (100°F)

NOTE: The system performance can be evaluated and diagnosed by analysis of the compressor suction and discharge pressures. The following procedure is used to determine if the system is operating at normal pressures.

NOTE: The procedure varies depending on the ambient (shop) temperature. If the ambient temperature is 38°C (100°F) or lower, follow procedure 1. If the ambient temperature is over 38°C (100°F), follow procedure 2.

NOTE: If the A/C compressor cycles at any time during this test, refer to the diagnostic table.

1. Drive the vehicle or run the engine until it reaches normal operating temperature.

2. Connect a manifold gauge set or refrigerant service center with high-pressure and low-pressure gauges to the refrigerant system.

3. Set the climate controls.
   - If equipped with manual climate control, set the A/C controls for normal A/C-PANEL mode, full COOL temperature, FRESH air, HI Blower. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
   - If equipped with ATC, set temperature to 15°C (60°F) (lowest possible temp setting) with the dual function disabled (if equipped). Manually set blower on high. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
   - If the vehicle is equipped with auxiliary climate control, set the auxiliary controls to full COOL in the PANEL mode at HI blower speed.

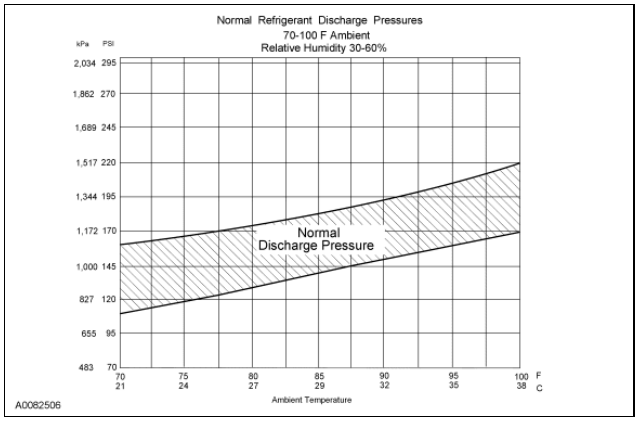
4. Open all vehicle windows and leave the hood open for the test. Open the rear hatch and/or rear doors (if equipped).

5. Confirm the compressor clutch is engaged and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.

6. Record the ambient (shop) temperature.

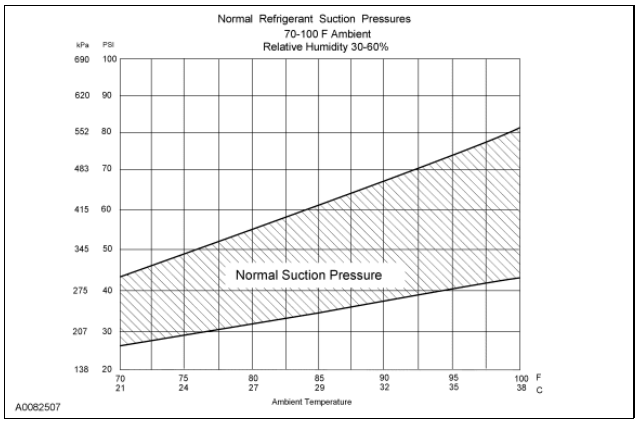
7. Record the discharge pressure. If the pressure is fluctuating, record the average value.

8. Determine if the discharge pressure falls within the normal operating limits using the Normal Refrigerant Discharge Pressures chart.



9. Record the suction pressure. If the pressure is fluctuating, record the average value.

10. Determine if the suction pressure falls between normal operating limits using the Normal Refrigerant Suction Pressures chart.



11. Proceed to the diagnostic table.

Procedure 2 — Ambient Temperature Above 38°C (100°F)

NOTE: The system performance can be evaluated and diagnosed by analysis of the compressor suction and discharge pressures. The following procedure is used to determine if the system is operating at normal pressures.

NOTE: The procedure varies depending on the ambient (shop) temperature. If the ambient temperature is 38°C (100°F) or lower, follow procedure 1. If the ambient temperature is over 38°C (100°F), follow procedure 2.

1. Drive the vehicle or run the engine until it reaches normal operating temperature.

2. Connect a manifold gauge set or refrigerant service center with high-pressure and low-pressure gauges to the refrigerant system.

3. Set the climate controls.
    - If equipped with manual climate control, set the A/C controls for normal A/C-PANEL mode, full COOL temperature, FRESH air, MED LO blower. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
    - If equipped with ATC, set temperature to 15°C (60°F) (lowest possible temp setting). Manually set blower to MED LO (3 to 4 bars). If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
    - If the vehicle is equipped with auxiliary climate control, set the auxiliary controls to full COOL in the PANEL mode at MED LO blower speed.

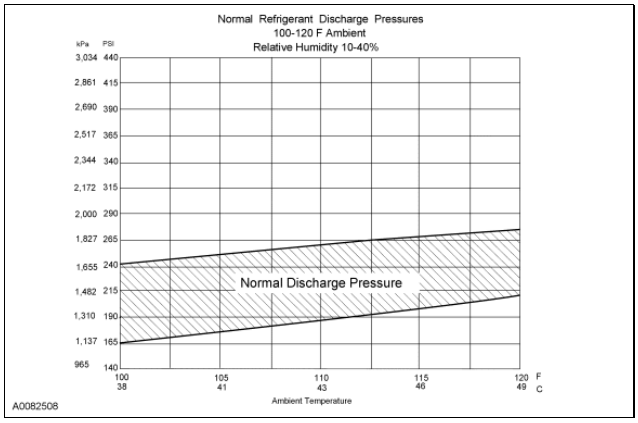
4. Open all vehicle windows and leave the hood open for the test. Open the rear hatch and/or rear doors (if equipped).

5. Confirm the compressor clutch is engaged and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.

6. Record the ambient (shop) temperature.

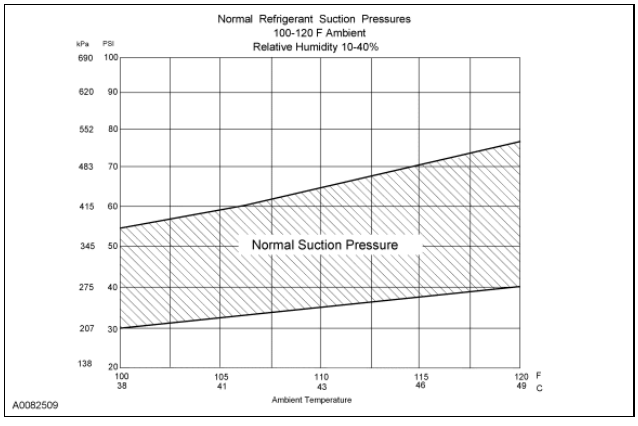
7. Record the discharge pressure. If the pressure is fluctuating, record the average value.

8. Determine if the discharge pressure falls within the normal operating limits using the Normal Refrigerant Discharge Pressures chart.



9. Record the suction pressure. If the pressure is fluctuating, record the average value.

10. Determine if the suction pressure falls between normal operating limits using the Normal Refrigerant Suction Pressures chart.



11. Proceed to the diagnostic table.

Diagnostic Table

1. **NOTE:** The following table is used to guide diagnosis of the refrigerant system if operating pressures are outside normal limits.

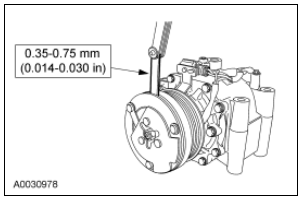
   Refer to the chart below.

High (Discharge) Pressure	Low (Suction) Pressure	Component — Causes
High or clutch cycling	High	Condenser — inadequate airflow.
High	Normal to high	Engine — overheating.
Normal to high	Normal	Refrigerant overcharge — air in refrigerant.
Normal to low	High	Thermostatic expansion valve
Normal to low	Normal to high	A/C suction line — partially restricted or plugged. [a]
Normal to low	Low or clutch cycling	Low refrigerant charge, A/C suction line — partially restricted or plugged.
Erratic operation or compressor not running		Evaporator discharge temperature sensor — poor connection at A/C clutch connector. A/C electrical circuit erratic — see A/C Electrical Circuit Wiring Diagram.
Normal to low	High	Compressor — low performance.
Additional Possible Cause Components Associated With Inadequate Compressor Operation		
• Compressor drive belt — loose • Compressor clutch — slipping • Clutch coil open — shorted, or loose mounting • Control assembly • Clutch wiring circuit — high resistance, open or blown fuse • Compressor operation interrupted by PCM		
Additional Possible Cause Components Associated With a Damaged Compressor		
• Incorrect clutch air-gap • Receiver/drier — plugged • Refrigerant leaks		

[a] Low pressure reading will be normal to high if pressure is taken at accumulator and if restriction is downstream of service access valve.

A/C Clutch Air Gap Adjustment

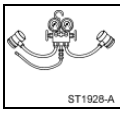
1. Check the A/C clutch air gap at three equally spaced places between the clutch hub and the A/C clutch pulley.



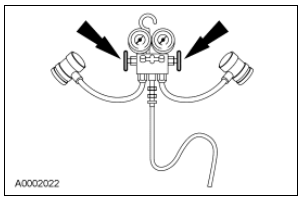
2. Remove the A/C clutch. Add or remove spacers between the A/C clutch and the compressor shaft until clearance is within specifications.

Manifold Gauge Set Connection

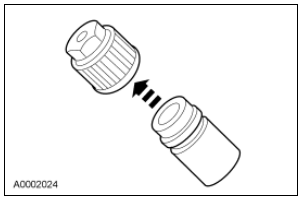
Special Tool(s)

 ST1928-A	R-134a Manifold Gauge Set 176-R032A or equivalent

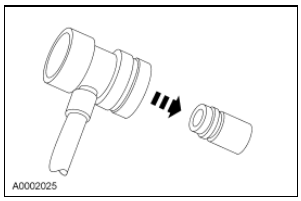
1. Turn both valves on the R-134a Manifold Gauge Set clockwise to close the low- and high-pressure hoses to the center manifold and center hose.



2. Remove the A/C charging valve cap from the high-pressure service gauge port valve.

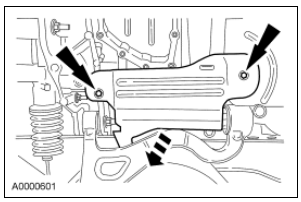


3. Connect the R-134a Manifold Gauge Set high-pressure hose and the R-134a high side quick disconnect to the high-pressure service gauge port valve.

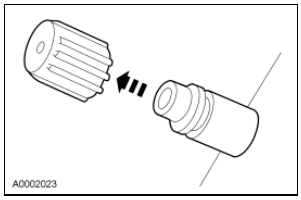


4. Raise the vehicle. For additional information, refer to Section 100-02 .

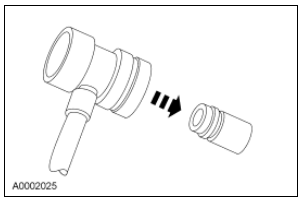
5. Remove the screws and the left sight shield.



6. Remove the A/C charging valve cap from the low-pressure service gauge port valve.



7. Connect the R-134a Manifold Gauge Set low-pressure hose and the R-134a low side quick disconnect to the low-pressure service gauge port valve.



8. To disconnect the manifold and gauge set, reverse the connection procedure.

Electronic Leak Detection

Special Tool(s)

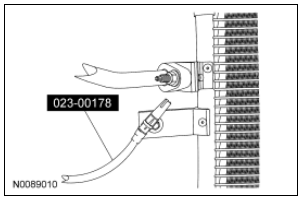
ST3072-A	Heated Pentode Halogen Leak Detector 023-00178 or equivalent

NOTE: Good ventilation is necessary in the area where electronic A/C leak testing is to be carried out. If the surrounding air is contaminated with refrigerant gas, the Heated Pentode Halogen Leak Detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner or other cleaning solvents can cause the same problem. Using a fan to ventilate the area to be tested before proceeding with the leak detection procedure is helpful in removing small traces of contamination from the air, but the fan should be turned off during actual testing.

NOTE: R-134a is heavier than air, and will tend to move downward from the source of the leak if present. It is possible that a leak may not be detected if the leak detector tip is held above the leaking fitting, line or component. Always be sure to thoroughly leak test below the fitting, line or component for the presence of R-134a as well as leak testing above and around.

1. **NOTE:** The system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.

   Leak test the refrigerant system using the Heated Pentode Halogen Leak Detector. Follow the instructions included with the Heated Pentode Halogen Leak Detector for handling and operation techniques.



Fluorescent Dye Leak Detection

Special Tool(s)

ST3073-A	Cordless/Rechargeable True UV LED Light ES 023-00182 or equivalent
ST3057-A	R-134a Loop/Add On Injector Kit-Set 219-00069 or equivalent
ST1928-A	R-134a Manifold Gauge Set 300-R0B40134AE or equivalent
ST3079A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 300-R0B34788-PROE or equivalent
ST3081-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 199-00067 or equivalent
ST3080-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 265-00012 or equivalent

Material

Item	Specification
Stay-Brite® R-134a Leak Detection Dye 164-R6060 (Rotunda)	—

Fluorescent Dye Injection Using a R-134a Refrigerant Management Machine and Dye Injector — Vehicles Requiring R-134a Addition

NOTE: This method of fluorescent dye injection requires the addition of R-134a from a R-134a Refrigerant Management Machine or R-134a Manifold Gauge Set hooked to an external tank to charge the dye into the refrigerant system. If adding fluorescent dye to a refrigerant system that is already fully charged, the R-134a Loop/Add On Injector Kit-Set method should be used.

NOTE: Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved UV blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Replacement suction accumulators and receiver/driers are shipped with a fluorescent dye "wafer" included in the desiccant bag which will dissolve after approximately 30 minutes of continued A/C operation. It is not necessary to add dye after flushing or filtering the refrigerant system because a new suction accumulator or receiver/drier is installed as part of the flushing or filtering procedure.

Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.

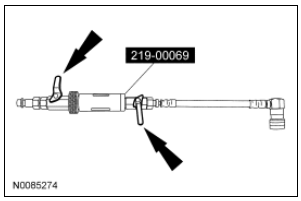
NOTE: Before using the R-134a Loop/Add On Injector Kit-Set for the first time, refer to the manufacturer's instructions on evacuation of any non-condensable gases from the hoses.

NOTE: Only connect the dye/lubricant injector from the R-134a Loop/Add On Injector Kit-Set when fluorescent dye is to be injected. The dye/lubricant injector has a one-way check valve that will prevent refrigerant system recovery and evacuation.

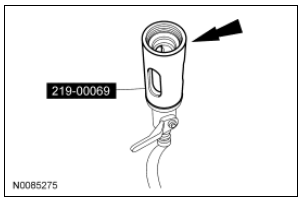
1. **NOTE:** If no R-134a pressure is present in the refrigerant system, the system should be evacuated before carrying out the injection procedure. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

   Connect a R-134a Refrigerant Management Machine or a R-134a Manifold Gauge Set to the refrigerant system service port valves.

2. Verify that the valves on the dye/lubricant injector from the R-134a Loop/Add On Injector Kit-Set are closed.



3. Fill the R-134a fluorescent dye injector reservoir with 7 ml (0.25 oz) of fluorescent dye.



4. Install the dye/lubricant injector between the low-pressure service gauge port valve and the R-134a Refrigerant Management Machine or R-134a Manifold Gauge Set.

5. **NOTE:** Following fluorescent dye injection, the refrigerant system should be fully charged to make sure of correct movement of the dye.

   Open all valves and inject the fluorescent dye into the refrigerant system by charging the refrigerant system with the required amount of R-134a.

6. When fluorescent dye injection is complete, close all valves.

7. Recover the refrigerant from the dye/lubricant injector.

8. Remove the dye/lubricant injector from the low-pressure service gauge port valve and the R-134a Refrigerant Management Machine or R-134a Manifold Gauge Set.

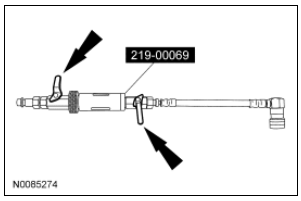
Fluorescent Dye Injection Using a R-134a Loop/Add On Injector Kit-Set — Vehicles Not Requiring R-134a Addition

NOTE: Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved UV blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Replacement suction accumulators and receiver/driers are shipped with a fluorescent dye "wafer" included in the desiccant bag which will dissolve after approximately 30 minutes of continued A/C operation. It is not necessary to add dye after flushing or filtering the refrigerant system because a new suction accumulator or receiver/drier is installed as part of the flushing or filtering procedure. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.

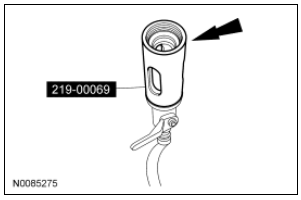
NOTE: Before using the R-134a Loop/Add On Injector Kit-Set for the first time, refer to the equipment manufacturer's instructions on evacuation of non-condensable gases from the hoses.

NOTE: Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off and cool.

1. Verify that the valves on the R-134a Loop/Add On Injector Kit-Set are closed.



2. Fill the R-134a Loop/Add On Injector Kit-Set reservoir with 7 ml (0.25 oz) of fluorescent dye.



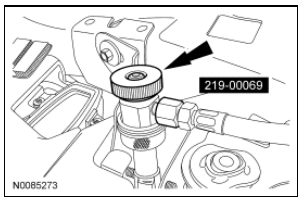
3. Install the R-134a Loop/Add On Injector Kit-Set between the high-pressure and low-pressure service gauge port valves.

4. ***NOTICE:*** **Make sure all tools and hoses are clear of the engine cooling fan and drive belt before starting the engine. Failure to keep tools and hoses clear from the engine cooling fan and drive belt will result in damage to the tools and/or vehicle.**

   With the A/C off, start the engine. Allow engine speed to stabilize below 1,000 rpm.

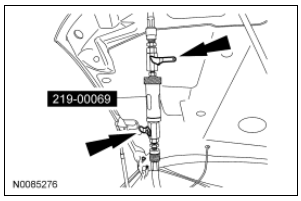
5. Set the A/C to the ON position.

6. Open the high-pressure service valve.

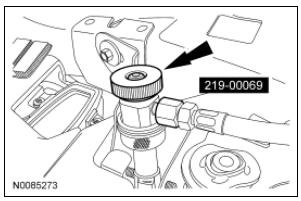


7. **NOTE:** To prevent pressure spike/liquid slug, crack the R-134a Loop/Add On Injector Kit-Set valves and slowly open to inject the fluorescent dye into the refrigerant system.

Open the R-134a Loop/Add On Injector Kit-Set valves and inject the fluorescent dye into the refrigerant system.

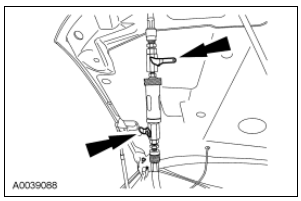


8. Close the high-pressure service valve to allow the pressure inside the R-134a Loop/Add On Injector Kit-Set to equalize with the suction side of the refrigerant system.



9. **NOTE:** Close the valves on the R-134a Loop/Add On Injector Kit-Set while the A/C compressor is operating.

   Close the valves on the R-134a Loop/Add On Injector Kit-Set.



10. **NOTE:** Leave all valves on the R-134a Loop/Add On Injector Kit-Set closed when not in use.

    Disconnect the high-pressure and low-pressure service valves and remove the R-134a Loop/Add On Injector Kit-Set from the vehicle.

Fluorescent Dye Detection

NOTE: Ford Motor Company vehicles are produced with R-134a fluorescent dye installed in the refrigerant system from the factory. The location of leaks can be pinpointed by the bright yellow-green glow of the fluorescent dye under a UV lamp. Since more than one leak can exist, make sure to inspect each component, line and fitting in the refrigerant system for a leak.

NOTE: Use of dye-enhancing glasses or goggles greatly improves the detection of the dye under the UV lamp.

NOTE: Not all UV lamps will fluoresce the dye used in Ford vehicles. All Rotunda UV lamps are optimized to fluoresce the dye.

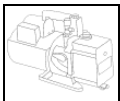
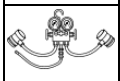
1. Check for leaks using a Rotunda-approved UV lamp and dye enhancing glasses.
   - Inspect all components, lines and fittings of the refrigerant system.

2. After the leak(s) is repaired, remove any traces of fluorescent dye with a general purpose oil solvent.

3. Verify the repair by running the vehicle for a short period of time and rechecking the area of the leak with a Rotunda-approved UV lamp.

Air Conditioning (A/C) System Recovery, Evacuation and Charging

Special Tool(s)

 ST1686-A	6.0 CFM Vacuum Pump 300-R0B15600E or equivalent
ST2742-A	Automatic Refrigerant Charging Meter 023-00155 or equivalent
 ST1928-A	R-134a Manifold Gauge Set 300-R0B40134AE or equivalent
ST3079A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 300-R0B34788-PROE or equivalent
ST3081-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 199-00067 or equivalent
ST3080-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 265-00012 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant System Recovery

NOTICE: **An Air Conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.**

NOTE: Ford Motor Company recommends the use of R-134a refrigerant management equipment that meets the requirements of the SAE J2788 standard.

1. Prior to recovering, the purity of the refrigerant must be verified. For additional information, refer to Refrigerant Identification Testing in this section.

2. Connect a R-134a Refrigerant Management Machine to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.

3. Recover the refrigerant from the system following the operating instructions provided by the equipment manufacturer. Note the amount of oil removed during the refrigerant recovery (if any). Add that same amount back into the system once repairs are complete.

4. Once the R-134a Refrigerant Management Machine has recovered the refrigerant, switch OFF the power supply.

5. Allow the system to set for about 2 minutes, and observe the system vacuum reading. If the vacuum is not lost, disconnect the recovery equipment.

6. If the system does lose vacuum, repeat Steps 3 through 5 until the vacuum level remains stable for 2 minutes.

7. Carry out the required repairs.

Refrigerant System Evacuation Using a R-134a Refrigerant Management Machine

1. Connect a R-134a Refrigerant Management Machine to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.

2. Evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the Vacuum Pump for a minimum of 45 minutes.

3. Turn OFF the Vacuum Pump. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held.

Refrigerant System Evacuation Using a R-134a Manifold Gauge Set and Vacuum Pump

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Connect the R-134a Manifold Gauge Set to the low-side and high-side service gauge port valves.

2. Connect the center (yellow) hose from the R-134a Manifold Gauge Set to the suction port on the Vacuum Pump.

3. Open all valves on the R-134a Manifold Gauge Set and both service gauge port valves.

4. Turn on the Vacuum Pump and evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the Vacuum Pump for a minimum of 45 minutes.

5. Close the high-side and low-side valves on the R-134a Manifold Gauge Set (not the service gauge port valves) and turn OFF the Vacuum Pump.

6. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held. If vacuum is not held for 5 minutes, leak test the system, repair the leak and evacuate the system again.

Refrigerant System Charging Using a R-134a Refrigerant Management Machine

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

2. Connect a R-134a Refrigerant Management Machine to the low-side and high-side service gauge port valves following the operating instructions provided by the equipment manufacturer.

3. Set the refrigerant charge amount, and charge the refrigerant system following the instructions provided by the equipment manufacturer.

Refrigerant System Charging Using a R-134a Manifold Gauge Set and Automatic Refrigerant Charging Meter

NOTE: Ford Motor Company recommends use of a R-134a Refrigerant Management Machine to carry out charging of the refrigerant system. If a R-134a Refrigerant Management Machine is not available, refrigerant system charging may be accomplished using a separate Automatic Refrigerant Charging Meter and R-134a Manifold Gauge Set.

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

2. Assemble the R-134a Manifold Gauge Set, Automatic Refrigerant Charging Meter and R-134a supply tank following the Automatic Refrigerant Charging Meter operating instructions.

3. Charge the refrigerant system following the Automatic Refrigerant Charging Meter operating instructions.

4. If the refrigerant flow stops before the refrigerant charge is complete, start the engine, select MAX A/C operation and allow the refrigerant charge to complete.

Air Conditioning (A/C) System Flushing

Special Tool(s)

ST2985-A	A/C Flush Adapter Kit 219-00074 or equivalent
ST2469-A	A/C Flush and Purge Fitting Kit 219-00024 (part of 219-00023) or equivalent
ST2466-A	A/C Flush and Purge Machine 219-00022 (part of 219-00023) or equivalent

Material

Item	Specification
A/C System Flushing Solvent YN-23	—
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

NOTICE: **An Air Conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.**

NOTICE: **Suction accumulator or receiver/drier, Thermostatic Expansion Valve (TXV) and/or evaporator core orifice, and hoses with mufflers, should be removed when flushing the Air Conditioning (A/C) system. Internal plumbing of these devices makes it impossible to correctly remove any residual-flushing agent. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material.**

NOTICE: **Only the listed A/C Flush and Purge Machine, A/C Flush and Purge Fitting Kit, A/C Flush Adapter Kit and A/C System Flushing Solvent are approved for use on Ford vehicles. No other flushing device or solvent is approved for flushing heat exchangers (Air Conditioning [A/C] condenser, A/C evaporator). Use of any other flusher or solvent may cause damage to the A/C system and the flushing unit.**

1. Recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

2. Disconnect the refrigerant lines from the heat exchanger(s) to be flushed.

3. Using the correct adapters from the A/C Flush Adapter Kit or A/C Flush and Purge Fitting Kit, connect the A/C Flush and Purge Machine to the heat exchanger to be flushed. Do not flush through the evaporator core orifice (if equipped), Thermostatic Expansion Valve (TXV) (if equipped) or hoses with mufflers. Internal plumbing and material make-up of these components make it impossible to correctly remove foreign material or residual flushing solvent.

4. **NOTE:** Use 3.785L (1 gal) of A/C System Flushing Solvent to flush the heat exchanger for a minimum of 15 minutes. The flush solvent may be used for one or both heat exchangers in the A/C system. However, the flush solvent is intended for one vehicle only. The filter used on the flushing unit is also intended for use on one vehicle only.

   Flush the heat exchanger for a minimum of 15 minutes.

5. Apply 621-862 kPa (90-125 psi) pressurized air to the component for a minimum of 30 minutes. The 30-minute purge time is required to force and evaporate all residual solvent from the A/C system component. Failure to successfully remove all residual solvent within the component can result in system damage when reconnected and operated. Dispose of the used flush solvent and filter in accordance with local, state and federal regulations.

6. **NOTE:** A/C system filtering as described in this section is optional if system flushing is carried out. However, the filter kit use is recommended after flushing if the A/C system contamination is extensive.

   Install a new A/C evaporator core orifice (if equipped) and/or TXV (if equipped) in any vehicle being serviced for an internal A/C compressor or desiccant failure.

7. Install new refrigerant hoses with mufflers if clogged with foreign material.

8. Install a new suction accumulator (if equipped), receiver/drier (if equipped) or receiver/drier cartridge (if equipped) in any vehicle being serviced for an internal A/C compressor or desiccant failure.

9. Reconnect the heat exchanger being serviced.

10. If a new A/C compressor is not to be installed, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

11. If a new A/C compressor is not to be installed, evacuate, leak test and charge the A/C system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

12. If a new A/C compressor is to be installed, refer to the A/C Compressor removal and installation procedure in Section 412-01 .

Refrigerant System Filtering Following Air Conditioning (A/C) Compressor Installation

Special Tool(s)

ST2985-A	A/C Flush Adapter Kit 219-00074 or equivalent
ST2469-A	A/C Flush and Purge Fitting Kit 219-00024 or equivalent

Material

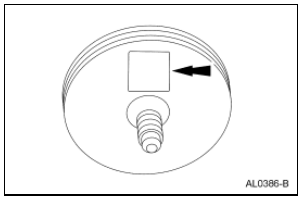
Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

NOTICE: **An Air Conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer's procedures and instructions.**

NOTICE: **On vehicles being serviced for an internal compressor or desiccant failure, a new suction accumulator or receiver/drier, Thermostatic Expansion Valve (TXV) or evaporator core orifice and any hoses containing mufflers must be installed prior to filtering the Air Conditioning (A/C) system. Internal plumbing of these devices makes it impossible to correctly remove any foreign material. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material. The filter is intended for use on one vehicle only.**

1. **NOTE:** The filter inlet is marked with a label on one side of the filter body.

   Orient the filter inlet toward the A/C condenser core.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2. ***NOTICE:*** **The flexible extension adapters included in the A/C Flush Adapter Kit are designed for low-pressure flushing and are not designed for use with a charged refrigerant system. Do not make the condenser fitting connections using the flexible extension adapters or damage to**

the adapters and loss of refrigerant will occur.

NOTE: The F8VZ-19E773-AB pancake filter is not permanently installed and will be removed at the end of this procedure.

Disconnect the condenser outlet fitting and temporarily install the pancake filter between the 2 halves of the fitting.

- Use flexible R-134a service hoses of 17,238 kPa (2,500 psi) burst rating.
- Make the connections using the correct adapters from the A/C Flush Adapter Kit and/or A/C Flush and Purge Fitting Kit.

3. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

4. Evacuate and charge the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

5. Check all refrigerant system hoses, lines and the position of the newly installed filters to be sure they do not interfere with other engine compartment components. If necessary, use tie straps to make adjustments.

6. Provide adequate airflow to the front of the vehicle (with a fan, if necessary). Select A/C operation and set the blower motor speed to maximum. Start the engine and let it idle briefly. Make sure the A/C system is operating correctly.

7. Using a scan tool, command the idle to gradually bring the engine up to 1,200 rpm by running it at lower rpms for short periods (first at 800 rpm, then at 1,000 rpm). Set the engine at 1,200 rpm and run it for one hour with the A/C system operating.

8. Stop the engine.

9. Recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

10. Remove the adapters, flexible hoses and pancake filter from between the condenser and the condenser to evaporator tube.

11. Discard the pancake filter. It can be used one time only.

12. Reconnect the condenser outlet fitting.

13. Evacuate, charge and leak-test the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

Refrigerant Oil Adding

Special Tool(s)

ST3057-A	R-134a Loop/Add On Injector Kit-Set 219-00069 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant Oil Adding

NOTE: During normal A/C operation, oil is circulated through the system with the refrigerant, and a small amount is retained in each component. If certain components of the system are removed, some of the PAG oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil lost by adding oil to the system with the new part.

1. Refer to the chart below for refrigerant oil adding amounts and methods of installation.

Component	PAG Oil Amount	Method of Adding
A/C Compressor	Refer to Adding Refrigerant Oil After A/C Compressor Replacement	Add or remove directly through A/C compressor low-side port before installation.
Suction Accumulator or Receiver/Drier	Refer to Adding Refrigerant Oil After New Suction Accumulator or Receiver/Drier Replacement	Add directly to suction accumulator inlet port or inject to low-side service port during system charging.
Evaporator Core	45 ml (1.5 fl oz) added to the amount collected during refrigerant recovery	Add directly to evaporator core inlet tube or inject to low-side service port during system charging.
Condenser Core	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Add directly to condenser core inlet or inject to low-side service port during system charging.
Evaporator Core Orifice or Thermostatic Expansion Valve (TXV)	The amount collected during refrigerant recovery	Inject to low-side service port during system charging.
A/C Pressure Relief Valve	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging.

Refrigerant Hose/Line	60 ml (2 fl oz) added to the amount collected during refrigerant recovery [a]	Inject to low-side service port during system charging.
O-ring Leak Repair	60 ml (2 fl oz) added to the amount collected during refrigerant recovery [b]	Inject to low-side service port during system charging.
Service Port Leak Repair	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging.

[a] If an excessive amount of PAG oil is lost due to a hose rupture/separation or other damage, the total system PAG oil capacity must be added.
[b] The amount specified may be used for one or multiple O-ring leak repairs. Do not multiply the PAG oil amount by the number of O-ring leaks being repaired.

Adding Refrigerant Oil After A/C Compressor Replacement

Service A/C compressors shipped without clutch and pulley

1. Rotate the old A/C compressor shaft 6 to 8 revolutions while collecting oil in a clean measuring device.
    - If the amount of oil drained from the old A/C compressor is between 85-142 ml (3-5 oz), pour the same amount plus 30 ml (1 oz) of clean PAG Refrigerant Compressor Oil (R-134a Systems) (YN-12-D) WSH M1C231-B or equivalent into the new A/C compressor.
    - If the amount of oil that was removed from the old A/C compressor is greater than 142 ml (5 oz), pour the same amount drained of clean PAG Refrigerant Compressor Oil (R-134a Systems) or equivalent into the new A/C compressor.
    - If the amount of oil that was removed from the old A/C compressor is less than 85 ml (3 oz), pour 85 ml (3 oz) of clean A/C Refrigerant Compressor Oil (R-134a Systems) or equivalent into the new A/C compressor.

Service A/C compressors shipped with clutch and pulley

2. Rotate the old A/C compressor shaft 6 to 8 revolutions while collecting oil in a clean measuring device.
    - If the amount of oil drained from the old A/C compressor is less than 89 ml (3 oz), remove 118 ml (4 oz) from the new A/C compressor.
    - If the amount of oil drained from the old A/C compressor is 89 ml (3 oz), remove 89 ml (3 oz) from the new A/C compressor.
    - If the amount of oil drained from the old A/C compressor is 118 ml (4 oz), remove 59 ml (2 oz) from the new A/C compressor.
    - If the amount of oil drained from the old A/C compressor is 148 ml (5 oz), remove 29 ml (1 oz) from the new A/C compressor.
    - If the amount of oil drained from the old A/C compressor is greater than 148 ml (5 oz), remove 0 ml (0 oz) from the new A/C compressor.

Adding Refrigerant Oil After New Suction Accumulator or Receiver/Drier Replacement

NOTE: This refrigerant oil adding method is to be used when a new suction accumulator or receiver drier only has been installed. If a new A/C compressor and evaporator core orifice or Thermostatic Expansion Valve (TXV) have also been installed due to system contamination, refer to the appropriate heading.

1. Drill one 12.7 mm (1/2 in) hole in the old suction accumulator or receiver/drier cylinder and drain the oil into a clean measuring cup.

2. Add the same quantity of new PAG oil, plus the amount collected during refrigerant recovery and 60 ml (2 fl oz).

Adding Refrigerant Oil After Multiple Component Replacement After A/C System Contamination

NOTE: This refrigerant oil adding method is to be used when a new A/C compressor, suction accumulator or receiver drier and evaporator core orifice or TXV have been installed due to system contamination and the A/C system has been flushed.

1. If the new A/C compressor is shipped with a new clutch and pulley already installed, remove the shipping caps and rotate the new A/C compressor shaft 6 to 8 revolutions while collecting the oil in a clean measuring cup.

2. Add 60 ml (2 fl oz) directly to the new A/C compressor suction port.

3. Inject the total vehicle PAG oil capacity minus 60 ml (2 fl oz) to the low-side service port during system charging. For the total PAG oil capacity specification, refer to the Specifications table in this section.

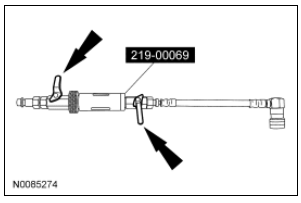
Oil Injection Using a Dye/Lubricant Injector

NOTE: If fluorescent leak detection dye is also to be added during A/C charging, the dye may be added to the dye/lubricant injector, from the R-134a Loop/Add On Injector Kit-Set, along with the PAG oil.

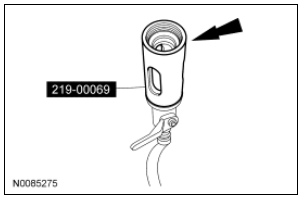
1. Evacuate the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

2. Assemble the dye/lubricant injector and the correct adapters from the R-134a Loop/Add On Injector Kit-Set to match the amount of refrigerant compressor oil to be injected.

3. Verify that all the valves on the dye/lubricant injector are closed.



4. Fill the dye/lubricant injector with the correct amount of clean, new PAG oil.



5. Install the dye/lubricant injector between the low-side service gauge port valve and the refrigerant service station or manifold gauge set.

6. Open all valves and charge the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

Refrigerant Identification Testing

Special Tool(s)

ST3090-A	Refrigerant Blend Identifier with Printer 198-00012 or equivalent

Refrigerant Identification

1. **NOTE:** A Refrigerant Blend Identifier with Printer must be used to identify gas samples taken directly from the refrigeration system or storage containers prior to recovering or charging the refrigerant system.

   Follow the instructions included with the Refrigerant Blend Identifier with Printer to obtain the sample for testing.

2. The Refrigerant Blend Identifier with Printer will display one of the following:
   - If the purity level of R-134a is 98% or greater by weight, the green PASS LED will light. The weight concentrations of R-134a, R-12, R-22, hydrocarbons and air will be displayed on the digital display.
   - If refrigerant R-134a does not meet the 98% purity level, the red FAIL LED will light and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will be displayed on the digital display.
   - If hydrocarbon concentrations are 2% or greater by weight, the red FAIL LED will light, "Hydrocarbon High" will be displayed on the digital display, and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will also be displayed on the digital display.

3. The percentage of air contained in the sample will be displayed if the R-134a content is 98% or greater. The Refrigerant Blend Identifier with Printer eliminates the effect of air when determining the refrigerant sample content because air is not considered a contaminant, although air can affect A/C system performance. When the Refrigerant Blend Identifier with Printer has determined that a refrigerant source is pure (R-134a is 98% or greater by weight) and air concentration levels are 2% or greater by weight, it will prompt the user if an air purge is desired.

4. If contaminated refrigerant is detected, repeat the refrigerant identification test to verify that the refrigerant is indeed contaminated.

Contaminated Refrigerant Handling

NOTICE: **If contaminated refrigerant is detected, DO NOT recover the refrigerant into R-134a recovery/recycling equipment. Recovery of contaminated refrigerant will contaminate the recovered refrigerant supply and may damage the recovery/recycling equipment.**

NOTE: A new suction accumulator or receiver/drier must be installed as directed by the A/C system flushing procedure.

1. Recover the contaminated refrigerant using suitable recovery-only equipment designed for capturing and storing contaminated refrigerant only.
    - If this equipment is not available, contact an A/C service facility in the area with the correct equipment to carry out this service.

2. Determine and correct the cause of the customer's initial concern.

3. Flush the A/C system.

4. Dispose of the contaminated refrigerant in accordance with all federal, state and local regulations.

General Specifications

Item	Specification
Magnetic Clutch	
Air gap between pulley and clutch plate	0.35-0.75 mm (0.014-0.030 in)
Refrigerant Lubricant	
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B
Refrigerant	
R-134a Refrigerant YN-19	WSH-M17B19-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor manifold bolt	22	16	—
A/C compressor bolts	25	18	—
A/C compressor clutch disc and hub nut	20	15	—
Receiver/drier fitting nut	8	—	71
Receiver/drier bracket bolt	7	—	62
A/C (peanut) fitting nut	8	—	71
Condenser bolts	6	—	53
Thermostatic expansion valve (TXV) manifold and tube bracket bolt	9	—	80
Heater tube bracket bolts	9	—	80
Wire harness bracket bolts	9	—	80
TXV fitting bolt	21	15	—
TXV outlet fitting	24	18	—
TXV inlet fitting	24	18	—
Thermal limiter bolt	6	—	53
Auxiliary coolant flow pump bolts	5	—	44

Air Conditioning

The A/C refrigerant system is a clutch cycling, thermostatic expansion valve type. The system components are:

- A/C compressor
- A/C clutch and clutch field coil
- A/C condenser core
- A/C evaporator core
- Thermostatic expansion valve (TXV)
- Receiver/drier
- Connecting refrigerant lines

The refrigeration system operation is controlled by the:

- TXV.
- evaporator discharge air temperature sensor.
- A/C compressor pressure relief valve.
- A/C pressure transducer.
- powertrain control module (PCM).
- dual-zone EATC module.
- ambient temperature sensor.

The refrigerant system incorporates a variable capacity A/C compressor. The A/C compressor clutch engagement is controlled by the vehicle PCM.

The evaporator discharge air temperature sensor senses evaporator discharge air temperature. The dual-zone EATC module monitors the evaporator discharge air temperature sensor and communicates with the PCM to control clutch cycling. The dual-zone EATC also monitors the ambient air temperature sensor and disables A/C operation when the ambient air temperature is below 0°C (32°F).

The A/C pressure transducer is located in the compressor discharge line and is monitored by the PCM. If high or low refrigerant pressures are experienced, the PCM will interrupt A/C compressor operation.

The pressure relief valve is installed in the compressor manifold and tube assembly and protects the system from excessively high refrigerant pressure.

The TXV, which is mounted to the evaporator core inlet and outlet tubes, contains an adjustable orifice which provides the restriction that separates the high and low-pressure liquid phases in the refrigeration system.

A/C Compressor and Clutch Assembly

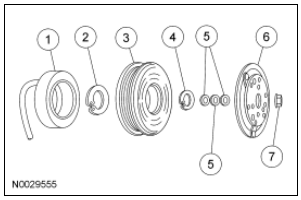
NOTE: Internal A/C compressor components are not serviced separately. The variable scroll compressor is serviced only as an assembly. The A/C clutch, A/C clutch pulley and the A/C clutch field coil are serviceable.

The SC105V Variable Scroll A/C compressor has the following characteristics:

- A variable capacity function controlled by a suction pressure sensing device.
- A fixed and orbiting scroll to provide refrigerant compression.
- A non-serviceable shaft seal.

- The A/C compressor uses PAG Refrigerant Compressor Oil (R-134a Systems). This oil contains special additives necessary for the A/C compressor.

The A/C compressor contains a thermal cutout switch which senses the compressor housing temperature. The switch will disengage the A/C compressor clutch if the housing temperature exceeds 120°C (247°F).



Item	Part Number	Description
1	19D798	A/C clutch field coil
2	W704579-S430	Field coil snap ring
3	19D784	A/C clutch pulley
4	W701742-S430	Pulley snap ring
5	19D648	A/C clutch hub spacers
6	19D786	A/C clutch
7	W704577-S301	A/C clutch nut

The SC105V magnetic A/C clutch has the following characteristics:

- It drives the compressor shaft.
- When battery positive voltage (B+) is applied to the A/C clutch field coil, the clutch disc and hub assembly is drawn toward the A/C clutch pulley.
- The magnetic force locks the clutch disc and hub assembly and the A/C clutch pulley together as one unit, causing the compressor shaft to rotate.
- When B+ is removed from the A/C clutch field coil, springs in the clutch disc and hub assembly move the clutch disc away from the A/C clutch pulley.

A/C Compressor Pressure Relief Valve

An A/C compressor pressure relief valve is incorporated into the compressor manifold and tube to:

- relieve unusually high refrigerant system discharge pressure buildups. For specifications regarding operating pressure(s), refer to Section 412-00 .
- prevent damage to the A/C compressor and other system components.
- avoid total refrigerant loss by closing after the excessive pressure has been relieved.

A/C Condenser Core

The A/C condenser core has the following characteristics:

- It is an aluminum fin and tube design heat exchanger located in front of the vehicle radiator.
- It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and by condensing gas to liquid refrigerant as it is cooled.

Refrigerant Lines

The receiver/drier manifold and tube assembly carries the high-pressure liquid from the condenser core to the receiver/drier, and from the receiver/drier to the thermostatic expansion valve (TXV) manifold and tube assembly. It attaches to the A/C receiver drier, uses O-ring seals, and also contains the high-pressure service port.

The thermostatic expansion valve manifold and tube assembly carries high-pressure liquid to the thermostatic expansion valve and low-pressure gas from the thermostatic expansion valve to the compressor manifold and tube assembly.

The compressor manifold and tube assembly carries the high-pressure gas from the A/C compressor to the condenser core. It also carries the low-pressure gas received from the thermostatic expansion valve manifold and tube assembly to the A/C compressor. The A/C manifold and tube assembly is attached to the A/C compressor, uses O-ring seals, and has:

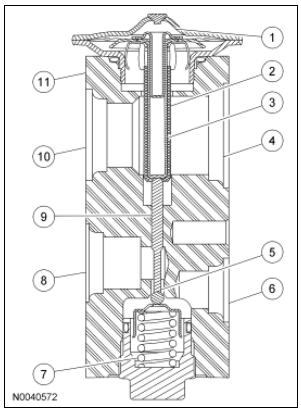
- a Schrader-type valve stem core fitting used to mount the A/C pressure transducer so that the A/C pressure transducer can be removed without discharging the A/C system.
- a serviceable high-pressure relief valve.

A/C Evaporator Core

The A/C evaporator core is the plate/fin type.

- A mixture of refrigerant and oil exits the TXV and enters the evaporator tank area through the 12.7 mm (1/2 in) tube.
- It exits the evaporator through the 15.9 mm (5/8 in) tube then passes through the TXV.

A/C Thermostatic Expansion Valve



Item	Description
1	Temperature sensing bulb
2	Insulator
3	Hollow core pin-type retainer
4	Outlet port — low-pressure liquid
5	Metering orifice
6	Inlet port — high-pressure liquid
7	Spring
8	

	Evaporator inlet port — low-pressure liquid
9	Pin
10	Evaporator outlet port — low-pressure gas
11	Housing

The TXV is located between the evaporator core lines and the thermostatic expansion valve manifold and tube assembly at the rear of the engine compartment. The TXV provides a restriction to the flow of refrigerant from the high pressure side of the refrigerant system, and separates the low pressure and high pressure sides of the refrigerant system. Refrigerant entering and exiting the evaporator core passes through the TXV through 2 separate flow paths. An internal temperature sensing bulb senses the temperature of the refrigerant flowing out of the evaporator core and adjusts an internal pin-type valve to meter the refrigerant flow into the evaporator core. The internal pin-type valve decreases the amount of refrigerant entering the evaporator core at lower temperatures, and increases the amount of refrigerant entering the evaporator core at higher temperatures.

Receiver/Drier

The receiver/drier is mounted to the engine fan shroud to the right of the vehicle center. The inlet tube of the receiver/drier attaches directly to the A/C condenser core and the outlet tube of the receiver/drier attaches to the thermostatic expansion valve inlet line.

The receiver/drier stores high-pressure liquid after it leaves the condenser core. A desiccant bag mounted in the receiver/drier removes any retained moisture.

The manifold and tube assembly that mounts to the top of the receiver/drier contains the high-pressure service port for the refrigerant system.

A/C Pressure Transducer

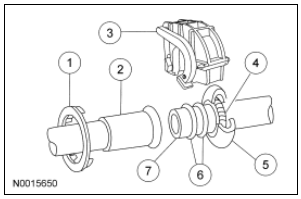
The A/C pressure transducer monitors the compressor discharge pressure and communicates with the powertrain control module (PCM). The PCM will interrupt A/C compressor operation in the event that the A/C pressure transducer indicates high system discharge pressures. It is also used to sense no or low charge conditions. If the pressure is below a predetermined value for a given ambient temperature, the PCM will not allow the clutch to engage.

- The A/C pressure transducer is mounted on a Schrader valve-type fitting on the A/C compressor to condenser discharge line.
- A valve depressor, located inside the threaded end of the A/C pressure transducer, presses on the Schrader valve stem and allows the A/C pressure transducer to monitor the compressor discharge pressure.
- When the compressor discharge pressure rises, the PCM will interrupt the A/C compressor clutch coil circuit and disengage the A/C compressor. When the pressure drops, the PCM will enable the A/C compressor circuit. For specifications regarding operating pressure(s), refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
- It is not necessary to discharge the refrigerant system to remove the A/C pressure cutoff switch.

Refrigerant System Dye

Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Replacement receiver/driers are shipped with a fluorescent dye "wafer" included in the desiccant bag, which will dissolve after approximately 30 minutes of continued A/C operation. It is not necessary to add dye after flushing or filtering the refrigerant system because a new receiver/drier is installed as part of the flushing or filtering procedure. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture, etc. For additional information, refer to Section 412-00 .

Spring Lock Coupling

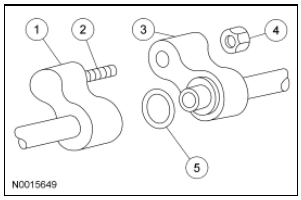


Item	Part Number	Description
1	—	Plastic indicator ring
2	—	Female fitting
3	19E746	A/C tube lock coupling clip
4	19E576	A/C tube lock coupling spring
5	—	Cage
6	19E889	O-rings (3 required)
7	—	Male fitting

When disconnecting or connecting spring lock couplings, observe the following:

- When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting.
- The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.
- Three O-ring seals are used to seal between the thermostatic expansion valve outlet tube and the compressor inlet tube. All other couplings have 2 O-ring seals.
- Use only the O-ring seals listed in the Ford Master Parts Catalog for the spring lock coupling.
- An A/C tube lock coupling clip is used to secure the coupling.

Peanut Fitting



Item	Part Number	Description
1	—	Female block (part of tube assembly)
2	—	Stud (part of female block)
3	—	Male block (part of 19712)

4	W520413-S301	Nut
5	19E889	O-ring seal

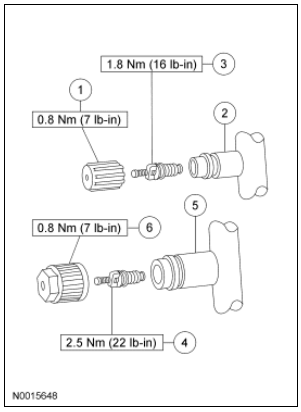
When disconnecting or connecting peanut fittings, observe the following:

- The male and female blocks of the peanut fitting are retained with a nut.
- Support the female fitting with a wrench to prevent twisting of the tubes.
- An O-ring seal is installed around the tube on the male block.
- When correctly assembled, the male and female fittings should be flush.
- Use only the O-ring seal listed in the Ford Master Parts Catalog.

Service Gauge Port Valves

The high-pressure service gauge port valve is located on the A/C receiver/drier manifold and tube assembly.

The low-pressure service gauge port valve is located on the manifold of the A/C compressor manifold and tube assembly at the A/C compressor.



Item	Part Number	Description
1	19D702	Low-pressure service gauge port valve cap
2	—	Low-pressure service gauge port valve
3	19D701	Low-pressure Schrader-type valve
4	19D701	High-pressure Schrader-type valve
5	—	High-pressure service gauge port valve
6	19D702	High-pressure service gauge port valve

The fitting is an integral part of the refrigeration line or component.

- Special couplings are necessary for both the high side and low side service gauge ports.
- A very small amount of leakage will always be detectable around the Schrader-type valve with the A/C charging valve cap removed, and is considered normal. A new Schrader-type valve core can be installed if the seal leaks excessively.
- The A/C charging valve caps are used as primary seals in the refrigerant system to prevent leakage through the Schrader-type valves from reaching the atmosphere. Always install and tighten the A/C charging valve caps (19D702) to the correct torque after they are removed.
- Always install the A/C charging valve cap on the service gauge port valves after repairing the refrigerant system.

Air Distribution and Filtering

NOTE: The air distribution system of this vehicle is factory equipped with a cabin air filter.

There are 2 sources of air available to the air distribution system:

- Outside air
- Recirculated air

Air distribution within the vehicle is controlled by the dual-zone electronic automatic temperature control (EATC) system in the AUTOMATIC mode, but it can be overridden by the driver if desired. Airflow mode doors are used to direct airflow within the evaporator and blower assembly and within the plenum chamber. Electrically powered mode door actuators are used to position the airflow mode doors. Refer to Section 412-00 for description and operation of each of the system functions.

Recirculated air can be selected by pushing the recirculating air button on the climate control assembly (EATC module). It may also be commanded by the EATC during AUTOMATIC and OFF modes. If the recirculating mode is selected in floor mode, the EATC module will automatically discontinue the recirculating air mode in floor mode, to reduce fogging of the windows.

Air enters the passenger compartment from the:

- instrument panel registers.
- floor duct.
- windshield defroster nozzle.
- side window demisters.

Passenger compartment air is exhausted from the vehicle through open windows or luggage compartment air vents.

Control Components

Dual-Zone Electronic Automatic Temperature Control

The dual-zone electronic automatic temperature control (EATC) module analyzes input from the following major sources:

- Temperature, function and blower selection (made by the vehicle occupants)
- In-vehicle temperature sensor
- Ambient temperature sensor
- Dual sunload sensor
- Vehicle speed
- Engine rpm
- Engine coolant temperature
- Actuator door position controls
- Driver and passenger heater core air discharge temperature sensors
- Evaporator discharge air temperature sensor

Using these inputs, the microcontroller determines the correct conditions for the following outputs:

- A/C clutch engagement
- Blower speed
- Panel door position
- Defrost door position
- Floor door position
- Air inlet duct door position
- Coolant control valve
- Electric water pump (3.9L engine)
- External temperature (outside temperature display)

Control System Inputs

Climate Control Assembly (EATC Module)

The dual-zone EATC module, located in the instrument panel, has the following features:

- A blower speed override control for manual input
- Individual temperature set controls for driver and passenger
- An A/C request control for manual input
- A recirculated air control for manual input
- A vacuum fluorescent display for displaying set temperatures for both the driver and passenger, external or ambient temperature, blower speed setting and diagnostic trouble codes (DTCs)
- An on-board diagnostic (OBD) feature to display DTCs.
- Air distribution mode overrides
- Rear defog control
- Heated wiper rest or heated windshield
- EXT temperature control to display external or outside temperature
- F/C control to toggle between English or metric settings

A/C Ambient Air Temperature Sensor

The A/C ambient air temperature sensor:

- is located on the grille opening reinforcement behind the grille near the center of the vehicle.
- contains a thermistor which measures the temperature of outside air as a resistance and sends that reading to the dual-zone EATC module.

In-Vehicle Temperature Sensor

The in-vehicle temperature sensor is located in the instrument cluster finish panel. The sensor operates in the following manner:

- A thermistor in the in-vehicle temperature sensor measures air temperature inside the passenger compartment.
- An automatic temperature control sensor hose is connected between the A/C plenum housing and the in-vehicle temperature sensor.
- The automatic temperature control sensor hose and venturi takes air from the A/C plenum housing to create a suction across the in-vehicle temperature sensor.
- The suction draws in-vehicle air into the in-vehicle temperature sensor and across the thermistor.

Dual A/C Sunload Sensor

The dual A/C sunload sensor:

- is located on the top center of the instrument panel in the defroster grille.
- contains photovoltaic diodes that are sensitive to sunlight.
- generates small amounts of current across the terminals depending upon the amount of light reaching the photovoltaic diode; therefore the only test that can be carried out is for an internal short circuit, an open circuit or sensor value out-of-range.
- contains an internal diagnostic resistor to allow the dual-zone EATC module to detect a difference between an open circuit and no sunlight.

Control System Outputs

A/C Blower Motor Speed Control

The A/C blower motor speed control is located on the A/C evaporator housing.

- The function of the A/C blower motor speed control is to convert low power signals from the dual-zone EATC module to a high current, variable ground feed for the blower motor.
- Blower motor speed is infinitely variable and is controlled by the dual-zone EATC control module software.
- A delay function provides a gradual increase or decrease in blower motor speed under all conditions.
- Controls the integral high blower relay which is engaged when maximum fan speed is selected.

Air Inlet Door Mode Door Actuator

The air inlet door mode door actuator is located on the heater core and evaporator core housing. The air inlet door position determines whether outside or recirculated air is being used.

- The actuator positions the air inlet door on command from the dual-zone EATC module.
- The air inlet door mode door actuator contains a reversible electric motor and a potentiometer.
- A 5-volt signal and ground reference is applied to the ends of the potentiometer. The voltage available at the wiper indicates the position of the potentiometer. The target position of the actuator is

calculated by the dual-zone EATC module and is matched with the wiper voltage of the actuator. The control module will drive the actuator motor in the direction necessary to make the actuator wiper voltage agree with the control module target position.

Defrost Door Mode Door Actuator

The defrost door mode door actuator is located on the plenum chamber. The actuator will position the defrost door fully open during defrost operation, partially open during floor/defrost and floor mode operation and fully closed during all other operations.

- The defrost door actuator positions the defrost door on command from the dual-zone EATC module.
- Operation of the defrost door actuator is the same as the air inlet door.

Panel Door Mode Door Actuator

The panel door mode door actuator is located on the plenum chamber. The actuator operates the panel door. The actuator positions the panel door fully open during panel mode and partially open during floor/panel operation. The door is closed during other operations.

- The panel door actuator positions the panel door on command from the dual-zone EATC module.
- Operation of the panel door actuator is the same as the air inlet door.

Floor Door Mode Door Actuator

The floor door mode door actuator positions the floor door fully open during floor and floor/panel and floor/defrost operations. The door is closed during other operations.

- The floor door mode door actuator positions the floor outlet door on command from the dual-zone EATC module.
- Operation of the floor door actuator is the same as the air inlet door.
- The floor outlet door actuator is in the full open position in OFF mode.

Heating and Ventilation

The heating and defrosting system:

- controls the vehicle air temperature and, during A/C operation, reduces the relative humidity of the air inside the vehicle.
- delivers heated or cooled air to maintain the vehicle interior temperature and comfort level.
- allows temperature to be adjusted individually by the driver and the passenger to maintain comfort.
- uses a reheat method to provide conditioned air to the passenger compartment. All airflow from the blower motor passes through the A/C evaporator core and the heater core. Temperature is regulated by reheating the air out of the evaporator core to achieve the desired temperature.
- controls the air temperature by regulating the flow of engine coolant to separate halves of the heater core. A dual solenoid actuated valve is used to control the flow of coolant.

The blower motor draws outside air through the air inlet filter and duct or draws recirculated air through the recirculated air duct.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer it to air passing through the heater core. The heater core is separated into 2 sections. Air passing through one section is directed to the driver side of the vehicle, while air passing through the other section is directed to the passenger side of the vehicle. The heater core has separate inlet ports with a common outlet port.

Blower Motor

The A/C blower motor pulls air from the air inlet and forces it into the evaporator housing and plenum assembly where it is distributed.

Dual Coolant Control Valve

The dual coolant control valve regulates the flow of engine coolant to each half of the heater core. Two electric solenoids, which are individually actuated by the dual-zone EATC module, are the control elements. Based on inputs from the dual-zone EATC module, the solenoids cycle open and closed to regulate the coolant flow to the heater core. The solenoids can be cycled at different speeds by the dual-zone EATC module in order to maintain different temperatures for each half of the heater core. Under certain conditions when heating is not required, the dual coolant flow valve will bypass the heater core by closing both solenoids.

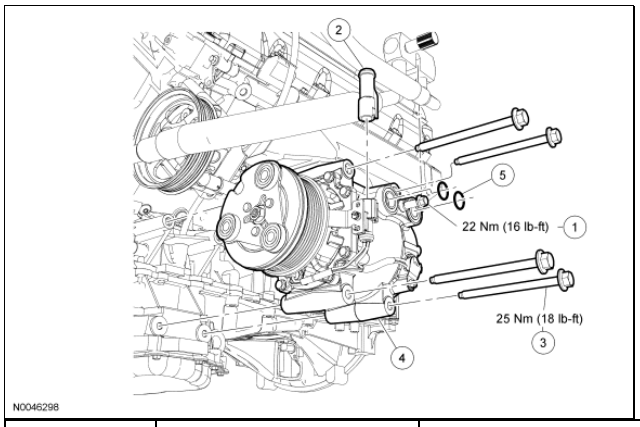
Auxiliary Water Pump

The auxiliary water pump is electrically driven and provides increased coolant flow during low engine speed operation. The pump is also used to circulate coolant after the engine is turned off under certain conditions.

Air Conditioning (A/C) Compressor

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W704692	Compressor manifold bolt
2	12B637	Field coil electrical connector
3	W704577	A/C compressor bolt (4 required)
4	19703	A/C compressor
5	19E889	O-ring (2 required)

Removal and Installation

NOTICE: **If installing a new air conditioning compressor due to an internal failure of the old unit, you must carry out the following procedures to remove contamination from the air conditioning system.**

- If A/C flushing equipment is available, carry out flushing of the air conditioning system prior to installing a new air conditioning compressor. For additional information, refer to Section 412-00 .
- If A/C flushing equipment is not available, carry out filtering of the air conditioning system after a new air conditioning compressor has been installed. For additional information, refer to Section 412-00 .
- Install a new thermostatic expansion valve (TXV), as directed by the A/C flushing or filtering procedure.
- Install a new receiver/drier, as directed by the A/C flushing or filtering procedure.

NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver/drier.

NOTE: If installing a new A/C compressor, the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil must be inspected and transferred from the old unit to the new unit if suitable for reuse.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. If flushing of the air conditioning system has not been carried out, recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the drive belt from the A/C compressor pulley.

4. Loosen the compressor manifold bolt and detach the compressor manifold.
   - Discard the O-ring seals.
   - To install, tighten to 22 Nm (16 lb-ft).

5. Disconnect the field coil electrical connector.

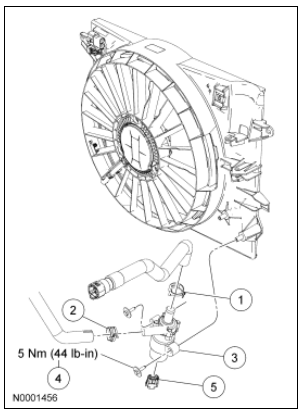
6. Remove the 4 A/C compressor bolts.
   - To install, tighten to 25 Nm (18 lb-ft).

7. Remove the A/C compressor.

8. To install, reverse the removal procedure.
   - Install new O-ring seals.
   - If filtering of the refrigerant system is not to be carried out, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

9. If filtering of the refrigerant system is not to be carried out, evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Auxiliary Coolant Flow Pump



Item	Part Number	Description
1	8287	Auxiliary coolant flow pump-to-heater hose and tube assembly hose clamp
2	8287	Auxiliary coolant flow pump-to-engine hose clamp
3	18D473	Auxiliary coolant flow pump
4	—	Auxiliary coolant flow pump bolt (2 required)
5	18C463	Auxiliary coolant flow pump electrical connector

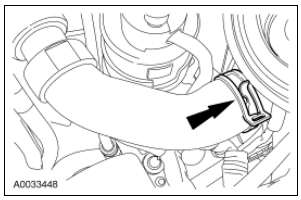
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the engine air cleaner outlet tube. For additional information, refer to Section 303-12 .

3. Drain the engine coolant. For additional information, refer to Section 303-03 .

4. Release the clamp and disconnect the upper radiator hose.



5. Release the auxiliary coolant flow pump-to-engine hose clamp and disconnect the hose.

6. Release the auxiliary coolant flow pump-to-heater hose and tube assembly hose clamp and disconnect the hose.

7. Disconnect the auxiliary coolant flow pump electrical connector.

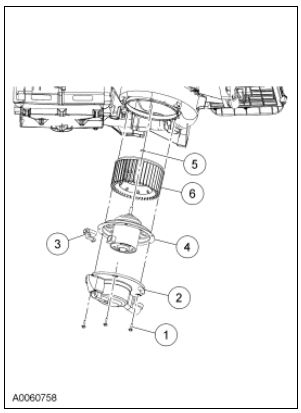
8. Remove the 2 auxiliary coolant flow pump bolts.
   - To install, tighten to 5 Nm (44 lb-in).

9. Remove the auxiliary coolant flow pump.

10. To install, reverse the removal procedure.
    - Clean and lubricate the coolant hoses with plain water only, if needed.

11. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Blower Motor

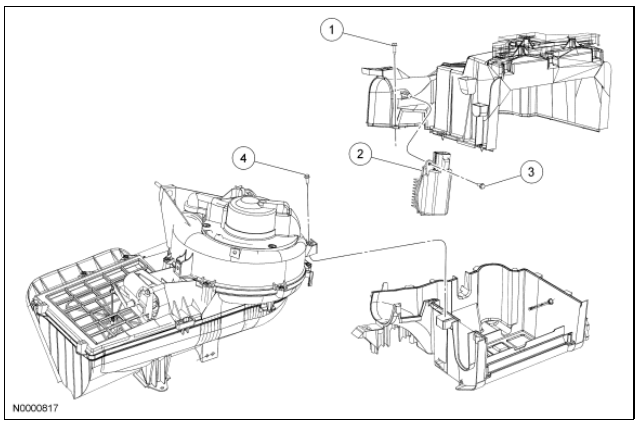


Item	Part Number	Description
1	W705314	Blower motor screw (3 required)
2	18515	Blower motor cover
3	19D887	Blower motor electrical connector
4	19805	Blower motor
5	18A287	Blower motor wheel clip
6	18504	Blower motor wheel

Removal and Installation

1. Remove the RH floor duct.
2. Remove the 3 blower motor screws.
3. Remove the blower motor cover.
4. Disconnect the blower motor electrical connector.
5. Remove the blower motor.
6. Remove the blower motor wheel clip.
7. Remove the blower motor wheel.
8. To install, reverse the removal procedure.

Blower Motor Speed Control

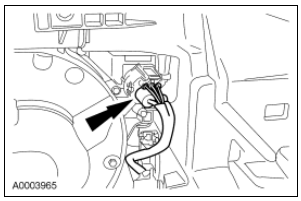


Item	Part Number	Description
1	W705314	Lower heater core and evaporator core housing to air inlet duct screw
2	19E624	Blower motor speed control
3	W705314	Blower motor speed control screw
4	W705314	Upper heater core and evaporator core housing to air inlet duct screw

Removal and Installation

1. Remove the heater core and evaporator core housing. For additional information, refer to Heater Core And Evaporator Core Housing in this section.

2. Disconnect the blower motor speed control electrical connector.

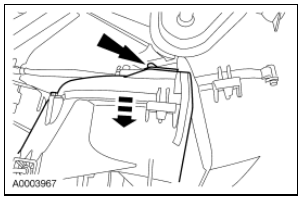


3. Remove the lower heater core and evaporator core housing to air inlet duct screw.

4. Remove the upper heater core and evaporator core housing to air inlet duct screw.

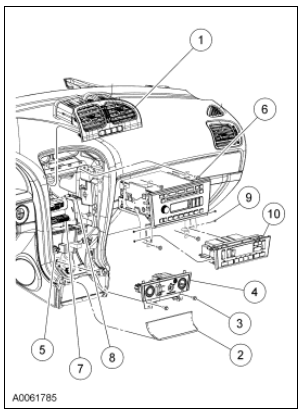
5. Remove the blower motor speed control screw.

6. Disengage the clip, separate the air inlet and evaporator housings and remove the blower motor speed control.



7. To install, reverse the removal procedure.

Climate Control Assembly



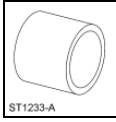
Item	Part Number	Description
1	19893C	Center instrument panel register
2	04644	Lower center finish panel
3	W704875	Switch panel screw (2 required)
4	04338F	Switch panel
5	14401	Power point electrical connector
6	W704875	Audio unit screw (4 required)
7	14401	Climate control assembly electrical connector
8	18812	Antenna cable
9	—	Climate control assembly screw (4 required)
10	19980	Climate control assembly

Removal and Installation

1. Remove the center instrument panel register.
2. Remove the lower center finish panel.
3. Remove the 2 switch panel screws.
4. Remove the switch panel.
5. Disconnect the power point electrical connector.
6. Remove the 4 audio unit screws.
7. Disconnect the climate control assembly electrical connector.
8. Disconnect the antenna cable from the audio unit.
9. Remove the 4 climate control assembly screws.
10. Remove the climate control assembly.
11. To install, reverse the removal procedure.

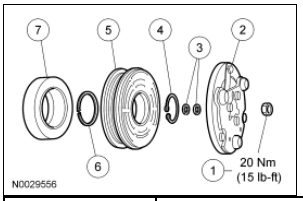
Clutch and Clutch Field Coil

Special Tool(s)

ST2382-A	Remover, Compressor Pulley 412-001 (T71P-19703-B)
ST2584-A	Holding Fixture, Compressor Clutch 412-103 (T95L-19703-AH)
 ST1233-A	Installer, A/C Compressor Pulley 412-109 (T97P-19D786-A)

Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

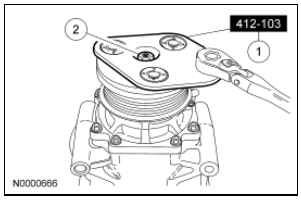


Item	Part Number	Description
1	18865	A/C clutch disc and hub nut
2	19D786	A/C clutch disc and hub
3	19D648	A/C clutch disc and hub spacers
4	W701742	A/C compressor pulley snap ring
5	19D784	A/C compressor pulley
6	W704579	A/C clutch field coil snap ring
7	19D798	A/C clutch field coil

Removal

1. Remove the A/C compressor. For additional information, refer to Air Conditioning (A/C) Compressor in this section.

2. Remove the A/C clutch disc and hub nut.
    1. Hold the A/C clutch disc and hub with the special tool.
    2. Remove the nut.

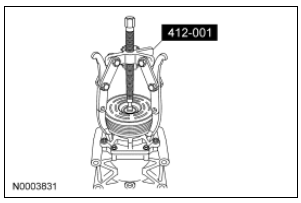


3. Remove the A/C clutch disc and hub.

4. Remove the A/C compressor pulley snap ring.

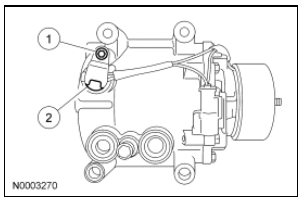
5. ***NOTICE:*** **Do not use air tools. Damage to the A/C compressor pulley may result.**

   Using the special tool, remove the A/C clutch pulley.



6. Remove the A/C clutch field coil snap ring.

7. Remove the A/C clutch field coil.
   1. Remove the bolt.
   2. Remove the thermal limiter and A/C clutch field coil.



Installation

1. **NOTE:** The A/C clutch components should be reused unless obvious signs of damage are found. If excessive grooving is found, a new A/C clutch disc and hub and a new A/C compressor pulley must be installed together. Otherwise, each component can be installed individually where needed.

   Visually inspect the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil for damage.

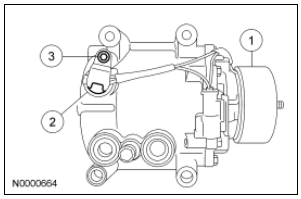
   - Inspect for physical damage including cracked or melted components or discoloration due to excessive heat.
   - Inspect for excessive wear including grooving in the A/C clutch disc and hub or A/C compressor pulley that is more than fingernail depth.
   - Inspect for roughness in the A/C compressor pulley bearing.

2. Clean the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil mounting surfaces.

3. Apply a pea-sized drop of silicone sealant to the thermal limiter socket.

4. Install the A/C clutch field coil.

1. Install the A/C clutch field coil.
2. Install the thermal limiter.
3. Tighten to 6 Nm (53 lb-in).

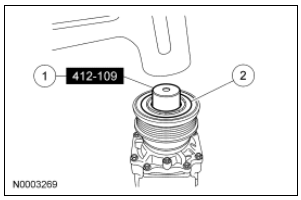


5. Install the A/C clutch field coil snap ring.

6. **NOTE:** The A/C compressor pulley is a tight fit on the A/C compressor. It must be correctly aligned during installation.

   Install the A/C compressor pulley.

   1. Install the special tool.
   2. Install the A/C compressor pulley.

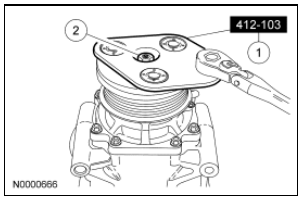


7. Install the A/C compressor pulley snap ring with the bevel side out.

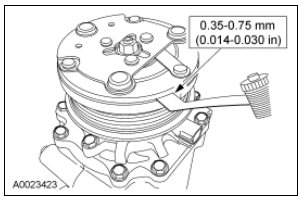
8. Place one nominal thickness A/C clutch disc and hub spacer inside the clutch hub spline opening.

9. Install the A/C clutch disc and hub.

10. Install the A/C clutch disc and hub nut.
    1. Hold the A/C clutch disc and hub with the special tool.
    2. Tighten to 20 Nm (15 lb-ft).



11. Measure and adjust the clutch air gap by removing or adding A/C clutch disc and hub spacers.

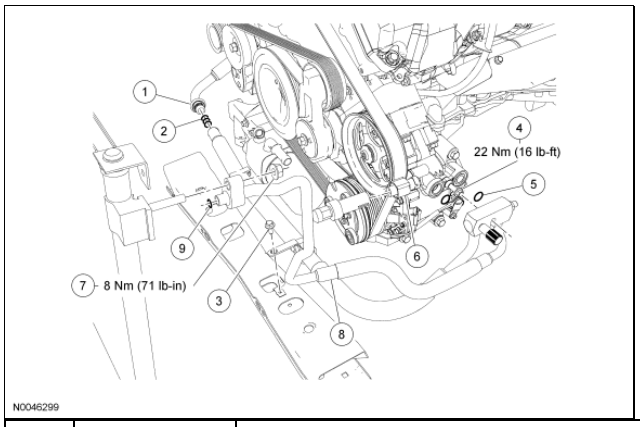


12. Install the A/C compressor. For additional information, refer to Air Conditioning (A/C) Compressor in this section.

Compressor Manifold and Tube Assembly

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	—	Thermostatic expansion valve (TXV) manifold and tube fitting (part of 19835A)
2	19E889	O-ring (3 required)
3	W705968	Compressor manifold and tube bracket bolt
4	W704692	Compressor manifold bolt
5	19E889	O-ring (2 required)
6	14290	A/C pressure transducer electrical connector
7	W520413	Condenser inlet fitting nut
8	19D734	Compressor manifold and tube assembly
9	19E889	O-ring

Removal and Installation

NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier.

1. Recover the refrigerant. For additional information, refer to Section 412-00 .
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
3. Remove the air cleaner outlet tube. For additional information, refer to Section 303-12 .

4. Disconnect the A/C pressure transducer electrical connector.

5. Remove the condenser inlet fitting nut.
   - Discard the O-ring seal.
   - To install, tighten to 8 Nm (71 lb-in).

6. Remove the center, LH and RH deflector shields.

7. Disconnect the thermostatic expansion valve (TXV) manifold and tube fitting.
   - Discard the O-ring seals.

8. Remove the compressor manifold and tube bracket bolt.

9. Loosen the compressor manifold bolt and detach the compressor manifold from the A/C compressor.
   - Discard the O-ring seals.
   - To install, tighten to 22 Nm (16 lb-ft).

10. Remove the compressor manifold and tube assembly.

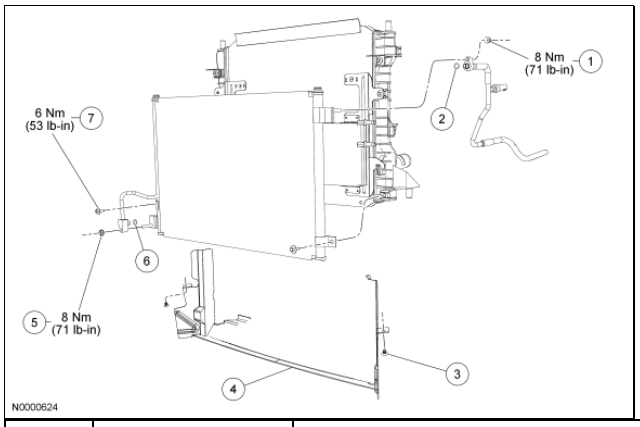
11. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

12. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Condenser Core

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Condenser inlet fitting nut
2	19E889	O-ring
3	389358	Lower air deflector pin-type retainer (2 required)
4	19E667	Lower air deflector
5	W520413	Condenser outlet fitting nut
6	19E889	O-ring
7	N805986	Condenser bolt (2 required)

Removal and Installation

NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the center underbody deflector shield.

4. Remove the condenser inlet fitting nut.
   - Discard the O-ring seal.
   - To install, tighten to 8 Nm (71 lb-in).

5. Remove the 2 lower air deflector pin-type retainers.

6. Remove the lower air deflector.

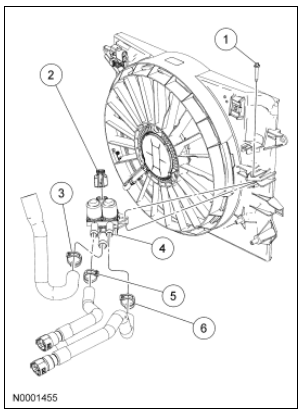
7. Remove the condenser outlet fitting nut.
    - Discard the O-ring seal.
    - To install, tighten to 8 Nm (71 lb-in).

8. Remove the 2 condenser bolts and the condenser.
    - To install, tighten to 6 Nm (53 lb-in).

9. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

10. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

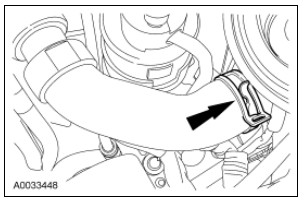
Dual Coolant Flow Valve



Item	Part Number	Description
1	—	Dual coolant control valve bolt
2	18C463	Dual coolant control valve electrical connector
3	8287	Dual coolant control valve hose clamp
4	18495	Dual coolant control valve
5	8287	LH heater hose clamp
6	8287	RH heater hose clamp

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the engine air cleaner outlet tube. For additional information, refer to Section 303-12 .
3. Drain the engine coolant. For additional information, refer to Section 303-03 .
4. Release the clamp and disconnect the upper radiator hose.



5. Release the dual control valve hose clamp and disconnect the hose.
6. Release the LH heater hose clamp and disconnect the hose.
7. Release the RH heater hose clamp and disconnect the hose.
8. Disconnect the dual coolant control valve electrical connector.
9. Remove the dual coolant control valve bolt.
10. Remove the dual coolant control valve.

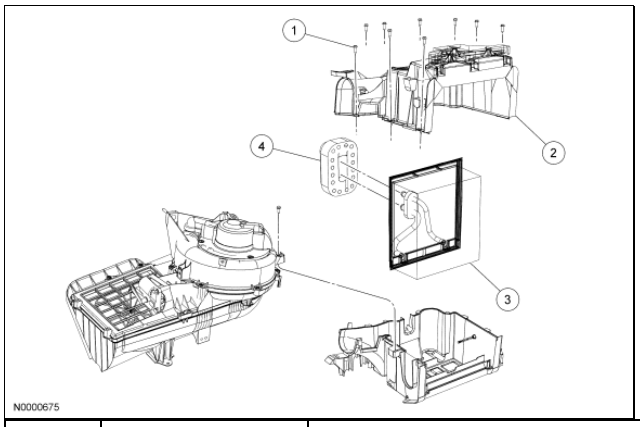
11. To install, reverse the removal procedure.
    - Clean and lubricate the coolant hoses with plain water only, if needed.

12. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Evaporator Core

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W705314	Heater core and evaporator core housing screw
2	19A897	Heater core and evaporator core housing cover
3	19860	Evaporator core
4	19A672	Dash panel seal

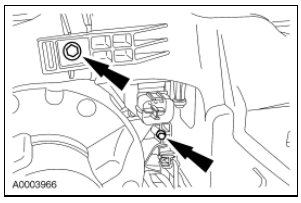
Removal and Installation

NOTE: If an evaporator core leak is suspected, the evaporator core must be vacuum leak tested before it is removed from the vehicle.

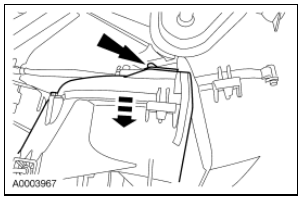
NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver/drier.

1. Remove the heater core and evaporator core housing. For additional information, refer to Heater Core And Evaporator Core Housing .

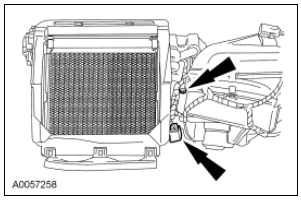
2. Remove the 2 screws which connect the air inlet housing to the evaporator core housing.



3. Disengage the clip and separate the air inlet housing from the evaporator core housing.



4. Disconnect and position the evaporator core housing wire harness aside.



5. Remove the dash panel seal.

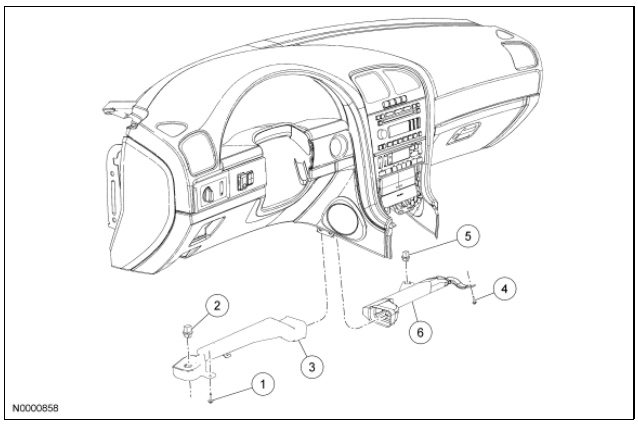
6. Remove the 8 heater core and evaporator core housing cover screws.

7. Remove the heater core and evaporator core housing cover.

8. Remove the evaporator core.

9. To install, reverse the removal procedure.
   - Install new O-ring seals.
   - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

Floor Duct

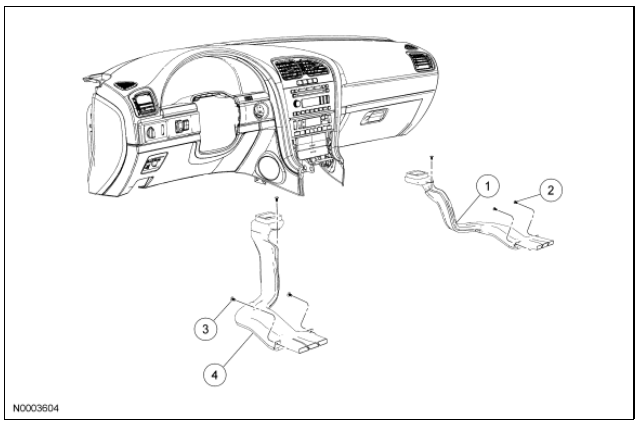


Item	Part Number	Description
1	W704875	LH floor duct screw
2	14401	LH courtesy lamp socket
3	19B680A	LH floor duct
4	W704875	RH floor duct screw
5	14401	Courtesy lamp socket
6	W704875	RH floor duct

Removal and Installation

1. Remove the lower instrument panel insulators.
2. Remove the LH floor duct screw.
3. Detach the LH courtesy lamp socket.
4. Remove the LH floor duct.
5. Remove the RH floor duct screw.
6. Detach the RH courtesy lamp socket.
7. Remove RH floor duct.
8. To install, reverse the removal procedure.

Footwell Duct — Rear

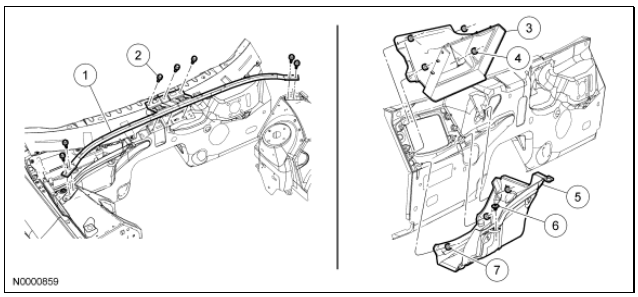


Item	Part Number	Description
1	18C420	RH rear footwell duct
2	W705589	RH rear footwell duct pin-type retainer (3 required)
3	W705589	LH rear footwell duct pin-type retainer (3 required)
4	18C420	LH rear footwell duct

Removal and Installation

1. Remove the front seats. For additional information, refer to Section 501-10 .
2. Remove the RH and LH lower cowl trim panels.
3. Remove the RH and LH front door sill plates and position the carpet away from the rear footwell ducts.
4. Remove the 3 LH rear footwell duct pin-type retainers.
5. Remove the LH rear footwell duct.
6. Remove the 3 RH rear footwell duct pin-type retainers.
7. Remove the RH rear footwell duct.
8. To install, reverse the removal procedure.

Fresh Air Inlet Duct

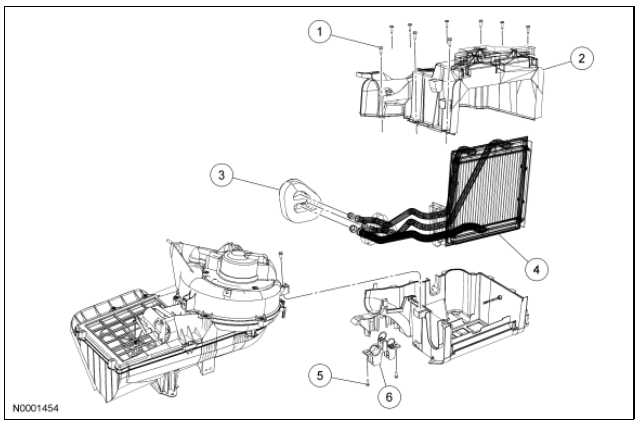


Item	Part Number	Description
1	3B336	Engine compartment brace
2	W705551	Engine compartment brace bolt (7 required)
3	01934	Fresh air inlet duct
4	—	Fresh air inlet duct nut (4 required)
5	016A50	Fresh air inlet duct insulator
6	—	Fresh air inlet duct insulator pin-type retainer
7	—	Fresh air inlet duct insulator nut (3 required)

Removal and Installation

1. Remove the cowl vent screen. For additional information, refer to Section 501-02 .
2. Remove the cabin air filter.
3. Remove the 7 engine compartment brace bolts.
4. Remove the engine compartment brace.
5. Remove the 4 fresh air inlet duct nuts.
6. Remove the fresh air inlet duct.
7. Remove the fresh air inlet duct insulator pin-type retainer.
8. Remove the 3 fresh air inlet duct insulator nuts.
9. Remove the fresh air inlet duct insulator.
10. To install, reverse the removal procedure.

Heater Core

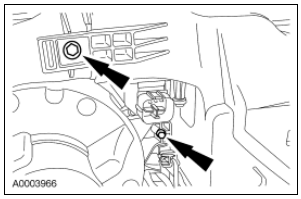


Item	Part Number	Description
1	W705314	Heater core and evaporator core housing screw (10 required)
2	19897	Heater core and evaporator core cover
3	18529	Dash panel seal
4	19B539	Heater core
5	W705314	Heater core tube bracket screw (2 required)
6	18A456	Heater core tube bracket

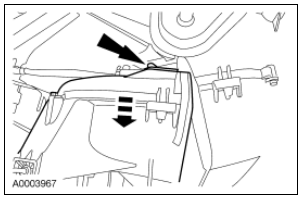
Removal and Installation

1. Remove the heater core and evaporator core housing. For additional information, refer to Heater Core And Evaporator Core Housing in this section.

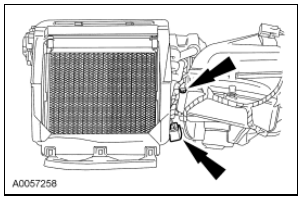
2. Remove the 2 screws which connect the air inlet housing to the evaporator core housing.



3. Disengage the clip and separate the air inlet housing from the evaporator core housing.



4. Disconnect and position the evaporator core housing wire harness aside.

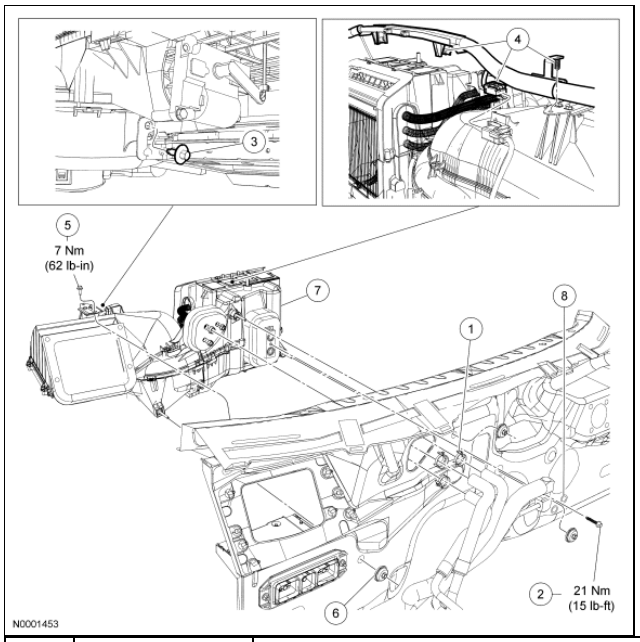


5. Remove the 8 remaining heater core and evaporator core cover screws.
6. Remove the heater core and evaporator core housing cover.
7. Remove the 2 heater core tube bracket screws.
8. Remove the heater core tube bracket.
9. Remove the heater core.
10. Remove the dash panel seal.
11. To install, reverse the removal procedure.

Heater Core And Evaporator Core Housing

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	8287	Heater core hose clamp (3 required)
2	N805334S2	Thermostatic expansion valve (TXV) manifold bolt
3	N606675	PCM bracket bolt
4	19D887	Wire harness
5	N706467	Heater core and evaporator core housing bracket bolt
6	W706467	Heater core and evaporator core housing nut (3 required)
7	19850	Heater core and evaporator core housing
8	19E889	TXV manifold O-rings (2 required)

Removal and Installation

1. Recover the refrigerant. For additional information, refer to Section 412-00 .
2. Drain the cooling system. For additional information, refer to Section 303-03 .
3. Remove the fresh air inlet duct. For additional information, refer to Fresh Air Inlet Duct in this section.
4. Remove the instrument panel. For additional information, refer to Section 501-12 .

5. Release the 3 heater core hose clamps and disconnect the heater hoses from the heater core.

6. Remove the TXV manifold bolt.
   - To install, tighten to 21 Nm (15 lb-ft).

7. Remove the PCM bracket bolt.

8. Detach the wire harness from the heater core and evaporator core housing.

9. Remove the heater core and evaporator core housing bracket bolt.
   - To install, tighten to 7 Nm (62 lb-in).

10. Remove the 3 heater core and evaporator core housing nuts.

11. Remove the heater core and evaporator core housing.

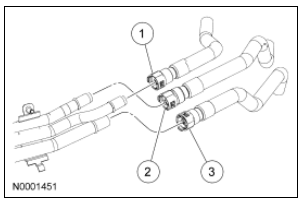
12. Remove the TXV manifold O-rings.

13. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

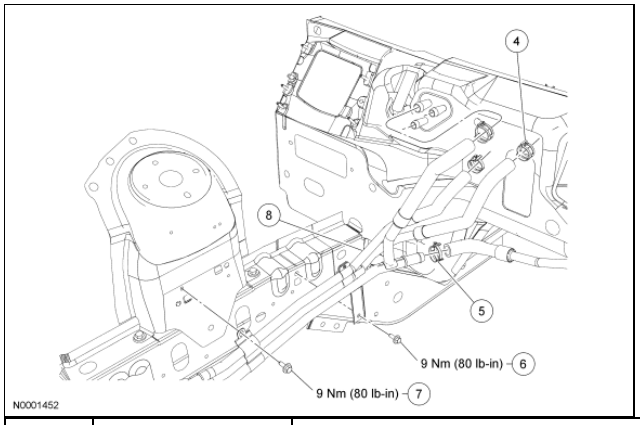
14. Fill the engine cooling system. For additional information, refer to Section 303-03 .

15. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Heater Hose



Item	Part Number	Description
1	18N345A	RH heater hose
2	18N345B	LH heater hose
3	18472C	Heater outlet hose



Item	Part Number	Description
4	8287	Heater core hose clamp (3 required)
5	8287	Bypass hose clamp
6	W702434	Rear heater hose and tube assembly bracket bolt
7	W702434	Front heater hose and tube assembly bracket bolt
8	18B402	Heater hose and tube assembly

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Drain the engine cooling system. For additional information, refer to Section 303-03 .
3. Remove the engine air cleaner outlet tube. For additional information, refer to Section 303-12 .
4. Remove the fresh air inlet duct. For additional information, refer to Fresh Air Inlet Duct in this section.
5. Disconnect the LH heater hose at the front of the heater hose and tube assembly.
6. Disconnect the RH heater hose at the front of the heater hose and tube assembly.
7. Disconnect the heater outlet hose at the front of the heater hose and tube assembly.

8. Remove the rear heater hose and tube assembly bracket bolt.
    - To install, tighten to 9 Nm (80 lb-in).

9. Remove the front heater hose and tube assembly bracket bolt.
    - To install, tighten to 9 Nm (80 lb-in).

10. Release the 3 heater core hose clamps and disconnect the heater hoses from the heater core.

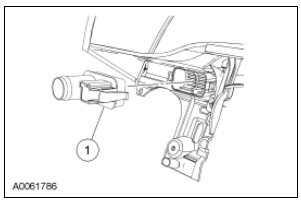
11. Release the bypass hose clamp and disconnect the bypass hose.

12. Remove heater hose and tube assembly.

13. To install, reverse the removal procedure.
    - Clean and lubricate the coolant hoses with plain water only if needed.

14. Fill the engine cooling system. For additional information, refer to Section 303-03 .

In-Vehicle Temperature Sensor

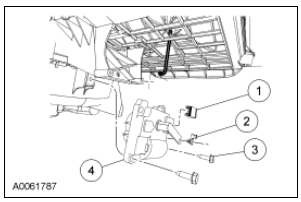


Item	Part Number	Description
1	19C734	In-vehicle temperature sensor

Removal and Installation

1. Remove the instrument cluster finish panel. For additional information, refer to Section 501-12 .
2. Remove the in-vehicle temperature sensor.
3. To install, reverse the removal procedure.

Mode Door Actuator — Air Inlet Door

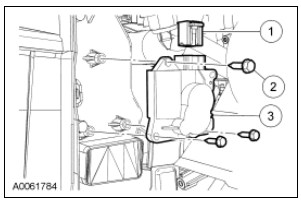


Item	Part Number	Description
1	19D887	Air inlet mode door actuator electrical connector
2	18A481	Air inlet mode door actuator linkage retaining clip
3	W701696-S	Air inlet mode door actuator screw (2 required)
4	19E616	Air inlet mode door actuator

Removal and Installation

1. Remove the RH floor duct.
2. Disconnect the air inlet mode door actuator electrical connector.
3. Remove the air inlet mode door actuator linkage retaining clip.
4. Remove the 2 air inlet mode door actuator screws.
5. Remove the air inlet mode door actuator.
6. To install, reverse the removal procedure.

Mode Door Actuator — Floor Door

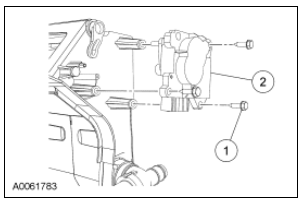


Item	Part Number	Description
1	14401	Floor mode door actuator electrical connector
2	W701696-S	Floor mode door actuator screw (3 required)
3	19E616	Floor mode door actuator

Removal and Installation

1. Remove the LH floor duct.
2. Disconnect the floor mode door actuator electrical connector.
3. Remove the 3 floor mode door actuator screws.
4. Remove the floor mode door actuator.
5. To install, reverse the removal procedure.

Mode Door Actuator — Defrost Door

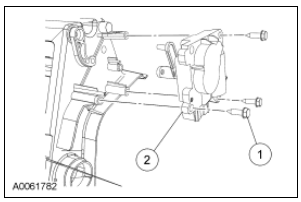


Item	Part Number	Description
1	W701696-S	Defrost door mode door actuator screw (3 required)
2	19E616	Defrost door mode door actuator

Removal and Installation

1. Remove the instrument cluster. For additional information, refer to Section 413-01 .
2. Remove the LH lower instrument panel insulator.
3. Remove the 3 defrost door mode door actuator screws.
4. Remove the defrost door mode door actuator.
5. To install, reverse the removal procedure.

Mode Door Actuator — Panel Door

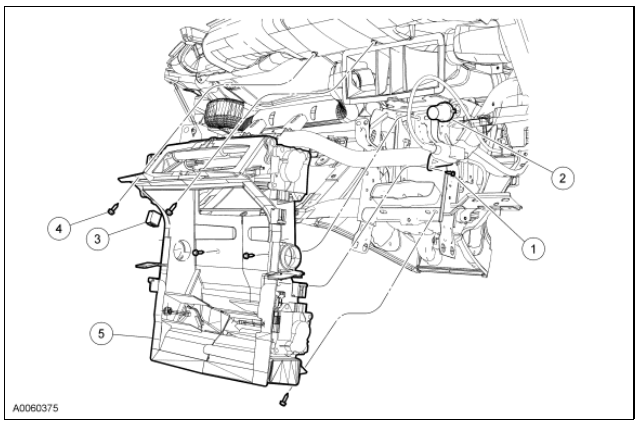


Item	Part Number	Description
1	W701696-S	Panel door mode door actuator screw (3 required)
2	19E616	Panel door mode door actuator

Removal and Installation

1. Remove the instrument panel. For additional information, refer to Section 501-12 .
2. Remove the 3 panel door mode door actuator screws.
3. Remove the panel door mode door actuator.
4. To install, reverse the removal procedure.

Plenum Chamber



Item	Part Number	Description
1	W701696	Shift interlock actuator screw
2	19E628	Aspirator tube
3	14401	Actuator electrical connector (3 required)
4	W701696	Plenum chamber screw (5 required)
5	19C698	Plenum chamber

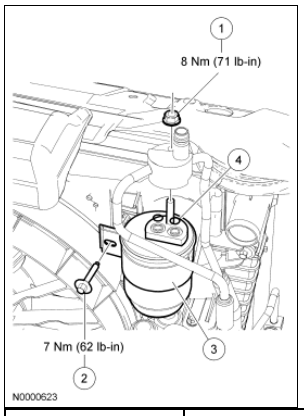
Removal and Installation

1. Remove the instrument panel. For additional information, refer to Section 501-12 .
2. Remove the shift interlock actuator screw.
3. Disconnect the 3 mode door actuator electrical connectors.
4. Remove the 5 plenum chamber screws.
5. Remove the plenum chamber.
6. To install, reverse the removal procedure.

Receiver Drier

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Receiver/drier fitting nut
2	—	Receiver/drier bracket bolt
3	19959	Receiver/drier
4	19E889	O-ring (2 required)

Removal and Installation

NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier.

1. Recover the refrigerant. For additional information, refer to Section 412-00 .

2. Remove the air cleaner outlet tube. For additional information, refer to Section 303-12 .

3. Remove the receiver/drier fitting nut.
   - Discard the O-ring seals.
   - To install, tighten to 8 Nm (71 lb-in).

4. Remove the receiver/drier bracket bolt.
   - To install, tighten to 7 Nm (62 lb-in).

5. Remove the receiver/drier.

6. To install, reverse the removal procedure.
   - Install new O-ring seals.

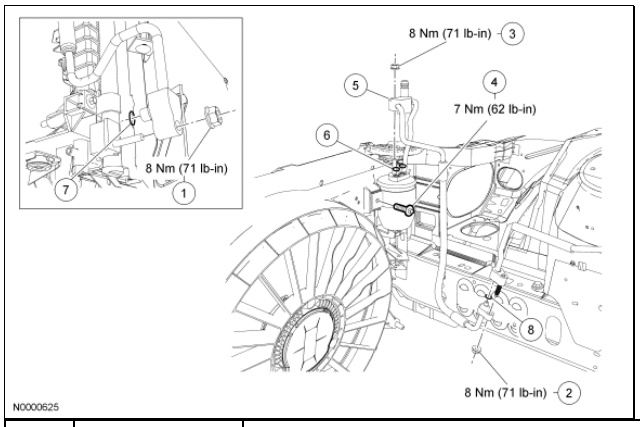
- Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

7. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Receiver Drier Manifold and Tube Assembly

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Condenser outlet fitting nut
2	W520413	Thermostatic expansion valve (TXV) manifold and tube fitting nut
3	W520413	Receiver/drier fitting nut
4	—	Receiver/drier bracket bolt
5	19835B	Receiver/drier manifold and tube assembly
6	19E889	O-ring (2 required)
7	19E889	O-ring
8	19E889	O-ring

Removal and Installation

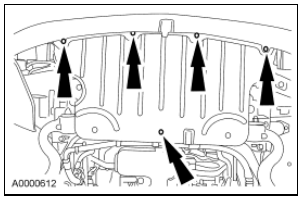
NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

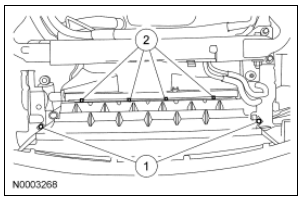
2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the air cleaner outlet tube. For additional information, refer to Section 303-12 .

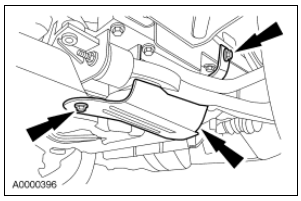
4. Remove the screws and the splash shield.



5. Remove the air deflector.
    1. Remove the pin-type retainers.
    2. Remove the clips and the air deflector.



6. Remove the RH deflector shield.



7. Remove the condenser outlet fitting nut.
    - Discard the O-ring seal.
    - To install, tighten to 8 Nm (71 lb-in).

8. Remove the thermostatic expansion valve (TXV) manifold and tube fitting nut.
    - Discard the O-ring seal.
    - To install, tighten to 8 Nm (71 lb-in).

9. Remove the receiver/drier fitting nut.
    - Discard the O-ring seals.
    - To install, tighten to 8 Nm (71 lb-in).

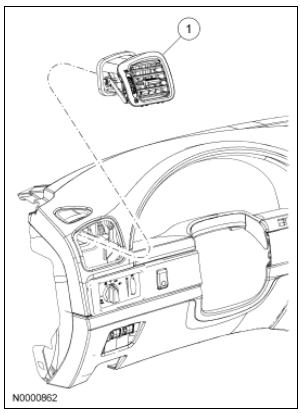
10. Remove the receiver/drier bracket bolt.
    - To install, tighten to 7 Nm (62 lb-in).

11. Remove the receiver/drier manifold and tube assembly.

12. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

13. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Register — Driver Side

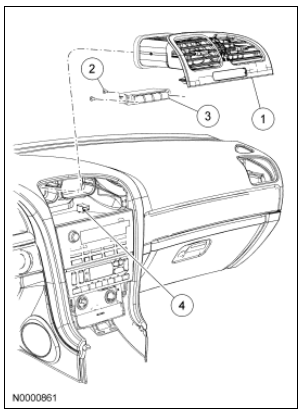


Item	Part Number	Description
1	19893A	Driver side register

Removal and Installation

1. Using a flat screwdriver to depress the tabs, remove the driver side register.
2. To install, reverse the removal procedure.

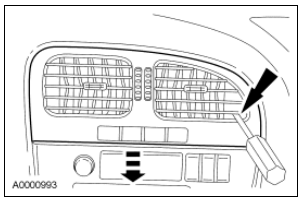
Register — Center



Item	Part Number	Description
1	19893A	Center register
2	W704874	Message center switch screw (2 required)
3	19D996	Message center switch assembly
4	14401	Message center switch electrical connector

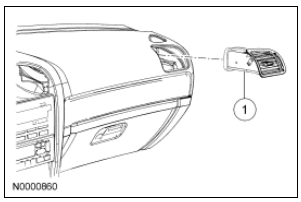
Removal and Installation

1. Insert a mini-pick in the pocket and pull the register from the instrument panel.



2. Disconnect the message center switch electrical connector.
3. Remove the 2 message center switch screws.
4. Remove the message center switch.
5. To install, reverse the removal procedure.

Register — Passenger Side



Item	Part Number	Description
1	19893B	Passenger side register

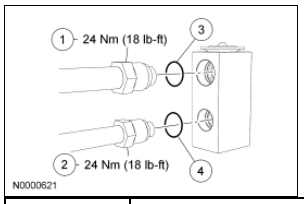
Removal and Installation

1. Using a flat screwdriver to depress the tabs, remove the passenger side register.
2. To install, reverse the removal procedure.

Thermostatic Expansion Valve

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	—	Evaporator outlet fitting (part of 19860)
2	—	Evaporator inlet fitting (part of 19860)
3	19E889	O-ring
4	19E889	O-ring

Removal and Installation

NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier.

1. Remove the evaporator core. For additional information, refer to Evaporator Core in this section.

2. Disconnect the evaporator outlet fitting.
   - Discard the O-ring seal.
   - To install, tighten to 24 Nm (18 lb-ft).

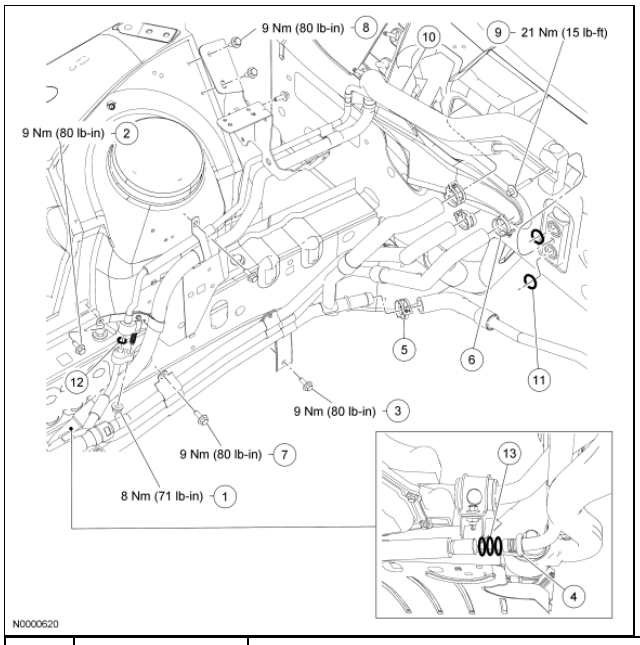
3. Disconnect the evaporator inlet fitting.
   - Discard the O-ring seal.
   - To install, tighten to 24 Nm (18 lb-ft).

4. To install, reverse the removal procedure.
   - Install new O-ring seals.

Thermostatic Expansion Valve Manifold and Tube Assembly

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Receiver/drier manifold and tube fitting nut
2	W702434	Thermostatic expansion valve (TXV) manifold and tube bracket bolt
3	W702434	Rear heater tube bracket bolt
4	—	Compressor manifold and tube inlet fitting (part of 19D734)
5	8287	Heater hose clamp
6	8287	Heater core hose clamp (3 required)
7	W702434	Front heater tube bracket bolt
8	W705968	Wire harness bracket bolt (3 required)
9	N80533452	TXV fitting bolt
10	19835A	TXV manifold and tube assembly
11	19E889	O-ring (2 required)
12	19E889	O-ring
13	19E889	O-ring (3 required)

Removal and Installation

NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier.

NOTE: Lubricate the coolant hoses with plain water only if needed.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Drain the engine coolant. For additional information, refer to Section 303-03 .

4. Remove the fresh air inlet duct. For additional information, refer to Fresh Air Inlet Duct in this section.

5. Remove the RH air deflector shield.

6. Remove the receiver/drier manifold and tube fitting nut.
   - Discard the O-ring seals.
   - To install, tighten to 8 Nm (71 lb-in).

7. Remove the thermostatic expansion valve (TXV) manifold and tube bracket bolt.

8. Remove the rear heater tube bracket bolt.
   - To install, tighten to 9 Nm (80 lb-in).

9. Disconnect the compressor manifold and tube inlet fitting.
   - Discard the O-ring seals.

10. Release the lower heater hose clamp and disconnect the lower heater hose.

11. Release the clamps and disconnect the heater core heater hoses.

12. Remove the front heater tube bracket bolt.
    - To install, tighten to 9 Nm (80 lb-in).

13. Remove the 3 wire harness bracket bolts.
    - To install, tighten to 9 Nm (80 lb-in).

14. Remove the TXV fitting bolt.
    - Discard the O-ring seals.
    - To install, tighten to 21 Nm (15 lb-ft).

15. Remove the TXV manifold and tube assembly.

16. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

17. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Instrument Cluster and Panel Illumination

The instrument cluster and panel illumination is used to provide backlighting to the instrument panel, switches and control components when the headlamp switch is in either the parking lamp ON or headlamp ON position. The level of intensity is adjustable by rotating the instrument panel dimmer switch either up to increase intensity or down to decrease intensity.

Instrument Cluster and Panel Illumination

Refer to Wiring Diagrams Cell 71 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adaptors, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

Instrument Cluster and Panel Lighting — Dimmable

The instrument panel dimmer switch allows the brightness level of the backlights and displays to be adjusted dependent upon the headlamp switch position and the instrument panel dimmer switch position. The instrument panel dimmer switch sends a signal to the instrument cluster which then sends a backlighting intensity and dimming curve command over the standard corporate protocol (SCP) communication network to the front electronic module (FEM). The FEM then sends a pulse width modulated (PWM) dimming signal to the instrument cluster, the dimmable light emitting diodes (LEDs), and the dimmable incandescent bulbs.

When the headlamp switch is in the parking lamp ON, headlamp ON, or the autolamp ON position and the autolamp feature is active, synchronized dimming of the dimmable components can be controlled with the instrument panel dimmer switch.

All backlighting is disabled when the battery saver function is activated.

Fault Management

The dimmable backlighting defaults to 100% intensity if an instrument panel dimmer switch failure occurs.

Inspection and Verification

NOTE: The instrument cluster and FEM must be configured upon installation. Refer to Section 418-01 .

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Instrument panel dimmer switch	• Central junction box (CJB) fuse 33 (10A) • Bulb(s) • Connectors • CJB • Interior auxiliary junction box • Joint connector 3 • Instrument cluster • Front electronic module (FEM) • Instrument panel dimmer switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for the FEM, refer to Section 419-10 .
    - No response/not equipped for the instrument cluster, refer to Section 413-01 .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out the self-test diagnostics for the instrument cluster.

7. If the DTCs retrieved are related to the concern, refer to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1246	Dim Panel Potentiometer Switch	Instrument Cluster	GO to Pinpoint Test E .

	Circuit Failure		
B1342	ECU is Defective	Instrument Cluster	DOCUMENT and CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is received again, INSTALL a new instrument cluster. REFER to Section 413-01 .
B2477	Module Configuration Failure	Instrument Cluster	REFER to Section 418-01 .
All Other DTCs	—	Instrument Cluster	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: One or More Module-Controlled Illumination Source(s) is Inoperative

Normal Operation

The headlamp switch supplies the instrument cluster with the headlamp switch position status. For additional information on the headlamp switch operation, refer to Section 417-01 . The dimmer switch provides the instrument cluster with the dimmer control status through signal circuit 8-LE10 (WH/BK) and return circuit 9-LE10 (BN/YE). The instrument cluster sends the illumination message to the front electronic module (FEM) over the standard corporate protocol (SCP) communication network, circuits 4-EG8 (GY/VT) and 5-EG8 (BU/WH), based upon the dimmer switch position. The FEM is supplied with illumination voltage through circuit 29S-DK22 (OG/YE) whenever the switched system power (SSP) relay number 2 is energized. When the headlamp switch is in the PARK, HEADLAMP, or AUTOLAMP ON position, the instrument cluster sends the FEM an illumination message and the FEM, in turn, provides pulse width modulation (PWM) voltage to the interior auxiliary junction box through circuit 64S-LH5 (BU/RD). The interior auxiliary junction box separates the PWM voltage and supplies it to sub-illumination sources through circuits 64S-LH4 (BU/RD), 64S-LH1 (BU/RD), 64S-LK9 (BU/RD), 64S-LH16 (BU/WH), 64S-LK1 (BU/RD), and the central junction box (CJB) through circuit 64S-AD2 (BU/RD). The CJB separates the PWM voltage and also supplies it to sub-illumination sources through circuits 64S-LH2 (BU/RD) and 64S-LH33 (BU/BK). The sub-illumination sources then provide the PWM voltage to the individual illuminating sources.

Possible Causes

- circuit 10-LE10 (GY/BK) open
- circuit 31-AD12 (BK/YE) open
- circuit 31-AH27A (BK/BU) open
- circuit 31-AJ7 (BK/BU) open
- circuit 31-AL19 (BK/GN) open
- circuit 31-CG15 (BK/OG) open
- circuit 31-GG25 (BK) open
- circuit 31-HC15 (BK/YE) open
- circuit 31-HC18 (BK/GN) open
- circuit 31-LH1 (BK/BU) open
- circuit 31-LH2 (BK/BU) open
- circuit 31-LH16 (BK/OG) open
- circuit 31-LH26 (BK) open

- circuit 31-LH28 (BK) open
- circuit 31-LH31 (BK) open
- circuit 31-LH33 (BK/GN) open
- circuit 31-LH42 (BK) open
- circuit 31-LH45 (BK/WH) open
- circuit 31-LH49 (BK/GN) open
- circuit 31-LK11 (BK) open
- circuit 31-LK21 (BK/GN) open
- circuit 31-LK34 (BK/GN) open
- circuit 31S-PG24 (BK/OG) open
- circuit 64-LK18 (BU/RD) open
- circuit 64S-AD2 (BU/RD) open
- circuit 64S-AH27 (BU) open
- circuit 64S-AL19 (BU/BK) open
- circuit 64S-CG15 (BU/WH) open
- circuit 64S-GG25 (BU/OG) open
- circuit 64S-LE10 (BU/YE) open
- circuit 64S-LH1 (BU/RD) open
- circuit 64S-LH2 (BU/RD) open
- circuit 64S-LH4 (BU/RD) open
- circuit 64S-LH14 (BU) open
- circuit 64S-LH15 (BU) open
- circuit 64S-LH16 (BU/WH) open
- circuit 64S-LH16A (BU/WH) open
- circuit 64S-LH26 (BU/BK) open
- circuit 64S-LH28 (BU) open
- circuit 64S-LH31 (BU/RD) open
- circuit 64S-LH32 (BU/RD) open
- circuit 64S-LH33A (BU/BK) open
- circuit 64S-LH33 (BU/BK) open
- circuit 64S-LH42 (BU/RD) open
- circuit 64S-LH45 (BU/OG) open
- circuit 64S-LH49 (BU/BK) open
- circuit 64S-LH50 (BU/YE) open
- circuit 64S-LK1 (BU/RD) open
- circuit 64S-LK9 (BU/RD) open
- circuit 64S-LK21 (BU/BK) open
- circuit 64S-LK29 (BU/RD) open
- circuit 64S-LK34 (BU/BK) open
- FEM
- CJB
- interior auxiliary junction box
- joint connector 3
- illumination source component

PINPOINT TEST A: ONE OR MORE MODULE-CONTROLLED ILLUMINATION SOURCE(S) IS INOPERATIVE

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take

A1 CHECK IF ONE OR MORE MODULE-CONTROLLED ILLUMINATION SOURCE(S) IS INOPERATIVE	
• Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • **Is only one illumination component inoperative?**	**Yes** If the DM100i or the CDX6 audio unit is inoperative, INSTALL a new audio unit, REFER to Section 415-00 . For all other individual sources inoperative, GO to A2 . **No** If the LH rear window control switch and the LH rear heated seat switch illumination controls are inoperative, GO to A4 . If the LH front window control switch, the memory set switch, the LH front door lock control switch, and the exterior mirror control switch illumination controls are inoperative, GO to A6 . If the RH front window control switch and the RH front door lock control switch illumination controls are inoperative, GO to A8 . If the RH rear window control switch and the RH rear heated seat switch illumination controls are inoperative, GO to A10 . If the steering wheel controls, the instrument panel dimmer switch, the headlamp switch, the message center switch, the instrument cluster, the adjustable pedal switch, the transmission selector lever, the traction control switch, the electronic park brake release switch, and the parking aid switch illumination controls are all inoperative, GO to A14 .
A2 CHECK THE VOLTAGE CIRCUIT TO THE ILLUMINATION SOURCE IN QUESTION	
• Turn the headlamp switch OFF. • Disconnect the inoperative illumination source connector. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position.	**Yes** GO to A3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

- Measure the voltage between the suspect illumination source, harness side and ground as follows:

Connector - Pin	Circuit
Headlamp Switch C205-2	64S-LH26 (BU/BK)
Instrument Panel Dimmer Switch C206-3	64S-LE10 (BU/YE)
Clockspring C218b-1	64-LK18 (BU/RD)
Message Center C253-1	64S-GG25 (BU/OG)
Transmission Selector Lever Illumination C307-1	64S-LK21 (BU/BK)
Memory Set Switch C503-6	64S-AH27 (BU)
LH Front Window Control Switch C504a-4	64S-LH14 (BU)
LH Front Door Lock Control Switch C505-2	64S-LH28 (BU)
Exterior Mirror Control Switch C527-6	64S-LH50 (BU/YE)
RH Front Window Control Switch C604-2	64S-LH31 (BU/RD)
RH Front Door Lock Control Switch C605-2	64S-LH42 (BU/RD)
LH Rear Window Control Switch C701-4	64S-LH16A (BU/WH)
LH Rear Heated Seat Switch C722-5	64S-LH15 (BU)
RH Rear Window Control Switch C801-4	64S-LH33A (BU/BK)
RH Rear Heated Seat Switch C822-5	64S-LH32 (BU/RD)
Adjustable Pedal Switch C2089-2	64S-AL19 (BU/BK)
Navigation Audio Unit C2253a-3	64S-LK34 (BU/BK)
Traction Control Switch C3208-6	64S-LH45 (BU/OG)
Electronic Park Brake Release Switch C3218-1	64S-CG15 (BU/WH)
Parking Aid Switch C9011-6	64S-LH49 (BU/BK)
Instrument Cluster C220a-7	64S-LK29 (BU/RD)

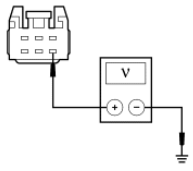
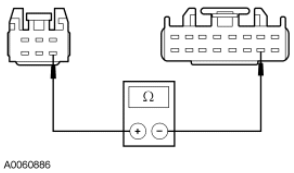
- **Is the voltage greater than 10 volts?**

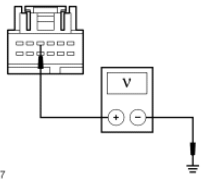
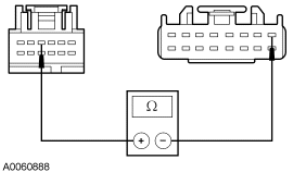
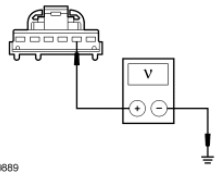
A3 CHECK THE GROUND CIRCUIT TO THE ILLUMINATION SOURCE IN QUESTION	
• Ignition OFF. • Turn the headlamp switch OFF. • Measure the resistance between the suspect illumination source, harness side and ground as follows:	**Yes** INSTALL a new component as necessary. TEST the system for normal operation. **No** REPAIR the circuit in question. TEST the system for normal operation.

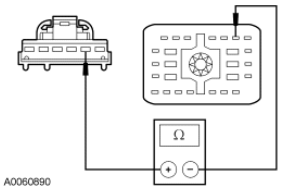
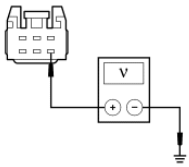
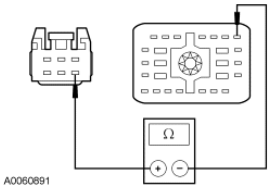
Connector - Pin	Circuit
Headlamp Switch C205-1	31-LH26 (BK)
Instrument Panel Dimmer Switch C206-5	10-LE10 (GY/BK)
Clockspring C218b-3	31S-PG24 (BK/OG)
Message Center C253-2	31-GG25 (BK)
Transmission Selector Lever Illumination C307-2	31-LK21 (BK/GN)
Memory Set Switch C503-2	31-AH27A (BK/YE)
LH Front Window Control Switch C504a-8	31-AJ7 (BK/BU)
LH Front Door Lock Control Switch C505-4	31-LH28 (BK)
Exterior Mirror Control Switch C527-3	31-AD12 (BK/YE)
RH Front Window Control Switch C604-3	31-LH31 (BK)
RH Front Door Lock Control Switch C605-4	31-LH42 (BK)
LH Rear Window Control Switch C701-1	31-LH16 (BK/OG)
LH Rear Heated Seat Switch C722-1	31-HC15 (BK/YE)
RH Rear Window Control Switch C801-1	31-LH33 (BK/GN)
RH Rear Heated Seat Switch C822-1	31-HC18 (BK/GN)
Adjustable Pedal Switch C2089-1	31-AL19 (BK/GN)
Navigation Audio Unit C2253a-4.	31-LK34 (BK/GN)
Traction Control Switch C3208-5	31-LH45 (BK/WH)
Electronic Park Brake Release Switch C3218-2	31-CG15 (BK/OG)
Parking Aid Switch C9011-5	

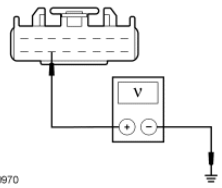
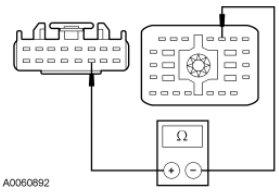
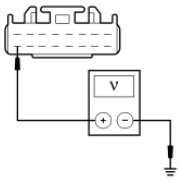
	31-LH49 (BK/GN)

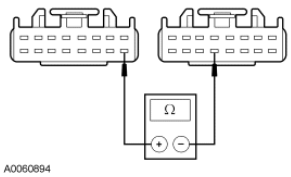
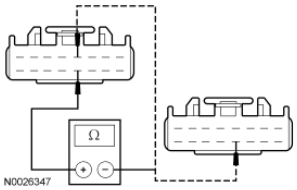
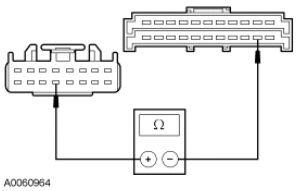
- **Is the resistance less than 5 ohms?**

A4 CHECK CIRCUIT 64S-LH16A (BU/WH) FOR VOLTAGE	
• Disconnect: LH Rear Window Control Switch C701. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Measure the voltage between the LH rear window control switch C701-4, circuit 64S-LH16A (BU/WH), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** REPAIR ground circuit 31-LH16 (BK/OG). TEST the system for normal operation. **No** GO to A5 .
A5 CHECK CIRCUIT 64S-LH16 (BU/WH) FOR AN OPEN	
• Turn the headlamp switch OFF. • Disconnect: Interior Auxiliary Junction Box C283b. • Measure the resistance between the LH rear window control switch C701-4, circuit 64S-LH16A (BU/WH), harness side and the interior auxiliary junction box C283b-10, circuit 64S-LH16 (BU/WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** REPAIR or INSTALL a new interior auxiliary junction box. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A6 CHECK CIRCUIT 64S-LH14 (BU) FOR VOLTAGE	
• Disconnect: LH Front Window Control Switch C504a. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Measure the voltage between the LH front window control switch C504a-4, circuit 64S-LH14 (BU), harness side and ground.	**Yes** REPAIR circuit 31-LH1 (BK/BU) or 31-AJ7 (BK/BU). TEST the system for normal operation. **No** GO to A7 .

 A0060887 • **Is the voltage greater than 10 volts?**	
A7 CHECK CIRCUIT 64S-LH1 (BU/RD) FOR AN OPEN	
• Turn the headlamp switch OFF. • Disconnect: Interior Auxiliary Junction Box C283b. • Measure the resistance between the LH front window control switch C504a-4, circuit 64S-LH14 (BU), harness side and the interior auxiliary junction box C283b-1, circuit 64S-LH1 (BU/RD), harness side.  A0060888 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR or INSTALL a new interior auxiliary junction box. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A8 CHECK CIRCUIT 64S-LH31 (BU/RD) FOR VOLTAGE	
• Disconnect: RH Front Window Control Switch C604. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Measure the voltage between the RH front window control switch C604-2, circuit 64S-LH31 (BU/RD), harness side and ground.  A0060889 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR ground circuit 31-LH2 (BK/BU) or 31-LH31 (BK). TEST the system for normal operation. **No** GO to A9 .
A9 CHECK CIRCUIT 64S-LH2 (BU/RD) FOR AN OPEN	
• Turn the headlamp switch OFF. • Disconnect: CJB C270d. • Measure the resistance between the RH front window control switch C604-2, circuit 64S-LH31 (BU/RD), harness side and the CJB C270d-25, circuit 64S-LH2 (BU/RD), harness side.	**Yes** GO to A12 . **No** REPAIR the circuit. TEST the system for normal operation.

 A0060890 • **Is the resistance less than 5 ohms?**	
A10 CHECK CIRCUIT 64S-LH33A (BU/BK) FOR VOLTAGE	
• Disconnect: RH Rear Window Control Switch C801. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Measure the voltage between the RH rear window control switch C801-4, circuit 64S-LH33A (BU/BK), harness side and ground.  A0060885 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR ground circuit 31-LH33 (BK/GN). TEST the system for normal operation. **No** GO to A11 .
A11 CHECK CIRCUIT 64S-LH33 (BU/BK) FOR AN OPEN	
• Turn the headlamp switch OFF. • Disconnect: CJB C270d. • Measure the resistance between the RH rear window control switch C801-4, circuit 64S-LH33A (BU/BK), harness side and the CJB C270d-26, circuit 64S-LH33 (BU/BK), harness side.  A0060891 • **Is the resistance less than 5 ohms?**	**Yes** GO to A12 . **No** REPAIR the circuit. TEST the system for normal operation.
A12 CHECK CIRCUIT 64S-AD2 (BU/RD) FOR VOLTAGE	
• Disconnect: Interior Auxiliary Junction Box C283b. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position.	**Yes** GO to A13 . **No** REPAIR or INSTALL a new interior

• Measure the voltage between the interior auxiliary junction box C283b pin 11, component side and ground.  A0060970 • **Is the voltage greater than 10 volts?**	auxiliary junction box. TEST the system for normal operation.
A13 CHECK CIRCUIT 64S-AD2 (BU/RD) FOR AN OPEN	
• Turn the headlamp switch OFF. • Measure the resistance between the interior auxiliary junction box C283b-11, circuit 64S-AD2 (BU/RD), harness side and the CJB C270d-24, circuit 64S-AD2 (BU/RD), harness side.  A0060892 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR or INSTALL a new CJB. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A14 CHECK THE INTERIOR AUXILIARY JUNCTION BOX ILLUMINATION	
• Disconnect: Interior Auxiliary Junction Box C283b. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Measure the voltage between the interior auxiliary junction box C283b pin 9, component side and ground.  A0060893 • **Is the voltage greater than 10 volts?**	**Yes** GO to A15 . **No** REPAIR or INSTALL a new interior auxiliary junction box. TEST the system for normal operation.
A15 CHECK CIRCUIT 64S-LH4 (BU/RD) FOR AN OPEN	
• Turn the headlamp switch OFF. • Disconnect: Interior Auxiliary Junction Box C283a. • Measure the resistance between the interior auxiliary junction box C283b-9, circuit 64S-LH4 (BU/RD), harness side and the interior auxiliary junction box	**Yes** GO to A16 . **No** REPAIR the circuit. TEST the system for normal operation.

C283a-13, circuit 64S-LH4 (BU/RD), harness side.  • **Is the resistance less than 5 ohms?**	
A16 CHECK THE INTERIOR AUXILIARY JUNCTION BOX FOR AN OPEN	
• Disconnect: Interior Auxiliary Junction Box C283d. • Measure the resistance between the interior auxiliary junction box C283a pin 13, component side and the interior auxiliary junction box C283d pin 13, component side; and between the interior auxiliary junction box C283a pin 13, component side and the interior auxiliary junction box C283a pin 5, component side.  • **Are the resistances less than 5 ohms?**	**Yes** If the adjustable pedal switch, instrument cluster, message center, headlamp switch, instrument panel dimmer switch, steering wheel controls, and navigation audio unit (if equipped) illumination controls are inoperative, GO to A17 . If the transmission selector lever, traction control switch, electronic park brake release switch, and parking aid switch illumination controls are inoperative, REPAIR circuit 64S-LK9 (BU/RD). **No** REPAIR or INSTALL a new interior auxiliary junction box. TEST the system for normal operation.
A17 CHECK CIRCUIT 64S-LK1 (BU/RD) FOR OPEN	
• Disconnect: Joint Connector 3 C224. • Measure the resistance between the interior auxiliary junction box C283d-13, circuit 64S-LK1 (BU/RD), harness side, and the joint connector 3 C224-13, circuit 64S-LK1 (BU/RD), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** REPAIR or INSTALL a new joint connector 3. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test B: The Control Illumination Is Inoperative

Normal Operation

The headlamp switch supplies the instrument cluster with the headlamp switch position status. For additional information on the headlamp switch operation, refer to Section 417-01 . The dimmer switch provides the instrument cluster with the dimmer control status through signal circuit 8-LE10 (WH/BK) and return circuit 9-LE10 (BN/YE). The instrument cluster sends the illumination message to the front electronic module (FEM) over the standard corporate protocol (SCP) communication network, circuits 4-EG8 (GY/VT) and 5-EG8 (BU/WH), based upon the dimmer switch position. The FEM is supplied with illumination voltage through circuit 29S-DK22 (OG/YE) whenever the switched system power (SSP) is energized. When the headlamp switch is in the PARK, HEADLAMP, or AUTOLAMP ON position, the instrument cluster sends the FEM an illumination message and the FEM, in turn, provides pulse width modulation (PWM) voltage to the interior auxiliary junction box through circuit 64S-LH5 (BU/RD). The interior auxiliary junction box separates the PWM voltage and supplies it to sub-illumination sources through circuits 64S-LH4 (BU/RD), 64S-LH1 (BU/RD), 64S-LK9 (BU/RD), 64S-LH16 (BU/WH), 64S-LK1 (BU/RD), and the central junction box (CJB) through circuit 64S-AD2 (BU/RD). The CJB separates the PWM voltage and also supplies it to the sub-illumination sources through circuits 64S-LH2 (BU/RD) and 64S-LH33 (BU/BK). The sub-illumination sources then provide the PWM voltage to the individual illuminating sources.

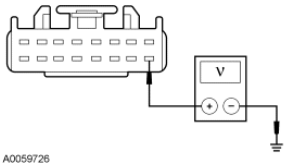
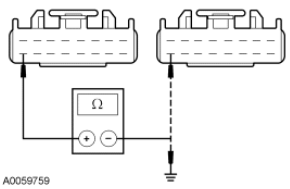
Possible Causes

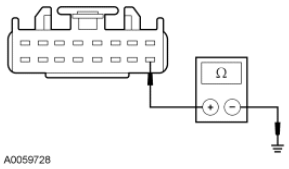
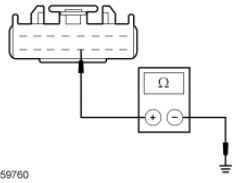
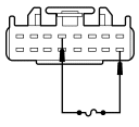
- fuse
- circuit 29S-DK22 (OG/YE) open or short to ground
- circuit 64-LK18 (BU/RD) short to ground
- circuit 64S-AD2 (BU/RD) short to ground
- circuit 64S-AH27 (BU) short to ground
- circuit 64S-AL19 (BU/BK) short to ground
- circuit 64S-CG15 (BU/WH) short to ground
- circuit 64S-GG25 (BU/OG) short to ground
- circuit 64S-LE10 (BU/YE) short to ground
- circuit 64S-LH1 (BU/RD) short to ground
- circuit 64S-LH2 (BU/RD) short to ground
- circuit 64S-LH3 (BU/WH) short to ground
- circuit 64S-LH4 (BU/RD) short to ground
- circuit 64S-LH5 (BU/RD) open or short to ground
- circuit 64S-LH14 (BU) short to ground
- circuit 64S-LH15 (BU) short to ground
- circuit 64S-LH16 (BU/WH) short to ground
- circuit 64S-LH16A (BU/WH) short to ground
- circuit 64S-LH26 (BU/BK) short to ground
- circuit 64S-LH28 (BU) short to ground
- circuit 64S-LH31 (BU/RD) short to ground
- circuit 64S-LH32 (BU/RD) short to ground
- circuit 64S-LH33 (BU/BK) short to ground
- circuit 64S-LH33A (BU/BK) short to ground
- circuit 64S-LH42 (BU/RD) short to ground
- circuit 64S-LH45 (BU/OG) short to ground
- circuit 64S-LH49 (BU/BK) short to ground
- circuit 64S-LH50 (BU/YE) short to ground
- circuit 64S-LK1 (BU/RD) short to ground
- circuit 64S-LK9 (BU/RD) short to ground
- circuit 64S-LK11 (BU) short to ground
- circuit 64S-LK21 (BU/BK) short to ground
- circuit 64S-LK29 (BU/RD) short to ground
- circuit 64S-LK34 (BU/BK) short to ground
- CJB
- interior auxiliary junction box

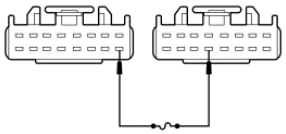
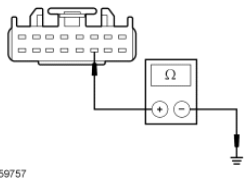
- instrument cluster
- FEM

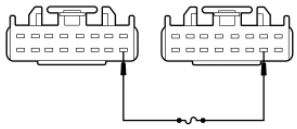
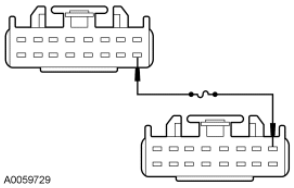
PINPOINT TEST B: THE CONTROL ILLUMINATION IS INOPERATIVE

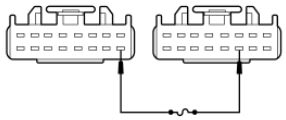
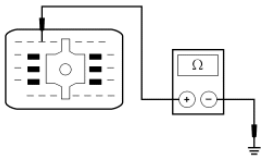
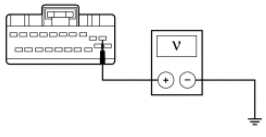
⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

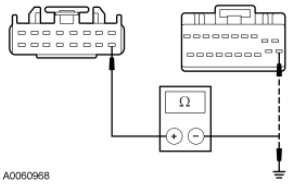
Test Step	Result / Action to Take
B1 CHECK CIRCUIT 64S-LH5 (BU/RD) FOR VOLTAGE	
• Disconnect: Interior Auxiliary Junction Box C283a. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Measure the voltage between the interior auxiliary junction box C283a-9, circuit 64S-LH5 (BU/RD), harness side and ground.  A0059726 • **Is the voltage greater than 10 volts?**	**Yes** GO to B2 . **No** GO to B12 .
B2 CHECK THE INTERIOR AUXILIARY JUNCTION BOX FOR AN OPEN OR A SHORT TO GROUND	
• Turn the headlamp switch OFF. • Disconnect: Interior Auxiliary Junction Box C283b. • Disconnect: Interior Auxiliary Junction Box C283d. • Measure the resistance between the interior auxiliary junction box C283a pin 9, component side and the interior auxiliary junction box C283b pin 9, component side; and between the interior auxiliary junction box C283a pin 9, component side and ground.  A0059759 • **Is the resistance less than 5 ohms between the interior auxiliary junction box pins, and greater than 10,000 ohms between the interior auxiliary junction box and ground?**	**Yes** GO to B3 . **No** REPAIR or INSTALL a new interior auxiliary junction box. TEST the system for normal operation.

B3 CHECK CIRCUIT 64S-LH4 (BU/RD) FOR A SHORT TO GROUND	
• Measure the resistance between the interior auxiliary junction box C283b-9, circuit 64S-LH4 (BU/RD), harness side and ground.  A0059728 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B4 . **No** REPAIR the circuit. TEST the system for normal operation.
B4 CHECK THE INTERIOR AUXILIARY JUNCTION BOX FOR A SHORT TO GROUND	
• Measure the resistance between the interior auxiliary junction box C283a pin 13, component side and ground.  A0059760 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B5 . **No** REPAIR or INSTALL a new interior auxiliary junction box. TEST the system for normal operation.
B5 CHECK CIRCUIT 64S-LK9 (BU/RD) FOR A SHORT TO GROUND	
• Connect a fused (5A) jumper wire between the interior auxiliary junction box C283a-9, circuit 64S-LH5 (BU/RD), harness side and the interior auxiliary junction box C283a-5, circuit 64S-LK9 (BU/RD), harness side.  A0059761 • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Monitor the cigar lighter, transmission selector lever, traction control (TC) switch, electronic park brake release switch, and parking aid switch. • **Do the cigar lighter, transmission selector lever, TC switch, electronic park brake release switch, and**	**Yes** GO to B6 . **No** REPAIR the followings circuit(s): 64S-LK11 (BU), 64S-LK21 (BU/BK), 64S-LH3 (BU/WH), 64S-LH45 (BU/OG), 64S-CG15 (BU/WH), 64S-LH49 (BU/BK), or 64S-LK9 (BU/RD) for a short to ground. TEST the system for normal operation.

parking aid switch illuminate?	
B6 CHECK THE ILLUMINATION POWER SUPPLY FOR A SHORT TO GROUND	
• Turn the headlamp switch OFF. • Connect a fused (5A) jumper wire between the interior auxiliary junction box C283a-9, circuit 64S-LH4 (BU/RD), harness side and the interior auxiliary junction box C283d-13, circuit 64S-LK1 (BU/RD), harness side.  A0059758 • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Monitor the adjustable pedal switch, navigation audio unit, instrument cluster, message center, headlamp switch, instrument panel dimmer switch, and the steering wheel controls. • **Do the adjustable pedal switch, navigation audio unit, instrument cluster, message center, headlamp switch, instrument panel dimmer switch, and the steering wheel controls illuminate?**	**Yes** GO to B7 . **No** REPAIR the following circuit(s): 64S-LK1 (BU/RD), 64S-AL19 (BU/BK), 64S-LK34 (BU/BK), 64S-LK29 (BU/RD), 64S-GG25 (BU/OG), 64S-LH26 (BU/BK), 64S-LE10 (BU/YE), or 64-LK18 (BU/RD) for a short to ground. TEST the system for normal operation.
B7 CHECK CIRCUIT 64S-AD2 (BU/RD) FOR A SHORT TO GROUND	
• Turn the headlamp switch OFF. • Disconnect: CJB C270d. • Measure the resistance between the interior auxiliary junction box C283b-11, circuit 64S-AD2 (BU/RD), harness side and ground.  A0059757 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B8 . **No** REPAIR the circuit. TEST the system for normal operation.
B8 CHECK THE LH REAR HEATED SEAT SWITCH AND LH REAR WINDOW CONTROL SWITCH ILLUMINATION	

• Connect: CJB 270d. • Connect a fused (5A) jumper wire between the interior auxiliary junction box C283a-9, circuit 64S-LH5 (BU/RD), harness side and the interior auxiliary junction box C283b-10, circuit 64S-LH16 (BU/WH), harness side.  A0059730 • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Monitor the LH rear heated seat switch and LH rear window control switch illumination. • **Do the LH rear heated seat switch and the LH rear window control switch illumination operate?**	**Yes** GO to B9 . **No** REPAIR the following circuit(s): 64S-LH16 (BU/WH), 64S-LH16A (BU/WH), or 64S-LH15 (BU) for a short to ground. TEST the system for normal operation.
B9 CHECK THE LH FRONT SWITCH ILLUMINATION	
• Turn the headlamp switch OFF. • Connect a fused (5A) jumper wire between the interior auxiliary junction box C283a-9, circuit 64S-LH5 (BU/RD), harness side and the interior auxiliary junction box C283b-1, circuit 64S-LH1 (BU/RD), harness side.  A0059729 • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Monitor the LH front door window control switch, LH front door lock control switch, memory set switch, and exterior mirror control switch illumination. • **Do the LH front door window control switch, LH front door lock control switch, memory set switch, and exterior mirror control switch illumination operate?**	**Yes** GO to B10 . **No** REPAIR the following circuit(s): 64S-LH1 (BU/RD), 64S-LH14 (BU), 64S-AH27 (BU), 64S-LH28 (BU), or 64S-LH50 (BU/YE) for a short to ground. TEST the system for normal operation.
B10 CHECK THE RH FRONT LOCK SWITCH AND RH FRONT WINDOW CONTROL SWITCH ILLUMINATION	
• Turn the headlamp switch OFF. • Connect a fused (5A) jumper wire between the interior auxiliary junction box C283a-9, circuit 64S-LH5 (BU/RD), harness side and the interior auxiliary junction	**Yes** REPAIR the following circuit(s): 64S-LH2 (BU/RD), 64S-LH31 (BU/RD), or 64S-LH42 (BU/RD) for a short to ground. TEST the system for

box C283b-11, circuit 64S-AD2 (BU/RD), harness side.  A0060966 • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Monitor the passenger window switch and passenger door lock switch illumination. • **Do the passenger window switch, and passenger door lock switch illumination operate?**	normal operation. **No** GO to B11 .
B11 CHECK THE CJB FOR A SHORT TO GROUND	
• Turn the headlamp switch OFF. • Disconnect: CJB C270d. • Measure the resistance between the CJB C270d pin 24, component side and ground.  A0060967 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the following circuit(s): 64S-LH33 (BU/BK), 64S-LH33A (BU/BK), and/or 64S-LH32 (BU/RD) for a short to ground. TEST the system for normal operation. **No** REPAIR or INSTALL a new CJB. TEST the system for normal operation.
B12 CHECK CIRCUIT 29S-DK22 (OG/YE) FOR VOLTAGE	
• Turn the headlamp switch OFF. • Disconnect: FEM C201f. • Measure the voltage between the FEM C201f-1, circuit 29S-DK22 (OG/YE), harness side and ground.  A0004436 • **Is the voltage greater than 10 volts?**	**Yes** GO to B13 . **No** VERIFY the CJB fuse 33 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
B13 CHECK CIRCUIT 64S-LH5 (BU/RD) FOR AN OPEN OR A SHORT TO GROUND	

• Measure the resistance between the interior auxiliary junction box C283a-9, circuit 64S-LH5 (BU/RD), harness side and the FEM C201f-11, circuit 64S-LH5 (BU/RD), harness side; and between the interior auxiliary junction box C283a-9, circuit 64S-LH5 (BU/RD), harness side and ground.  • **Is the resistance less than 5 ohms between the interior auxiliary junction box and the FEM, and greater than 10,000 ohms between the interior auxiliary junction box and ground?**	**Yes** GO to B14 . **No** REPAIR the circuit. TEST the system for normal operation.
B14 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. If the control illumination is still inoperative, GO to B15 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

B15 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: The Control Illumination Is Always On

Normal Operation

The headlamp switch supplies the instrument cluster with the headlamp switch position status. For additional information on the headlamp switch operation, refer to Section 417-01 . The dimmer switch provides the instrument cluster with the dimmer control status through signal circuit 8-LE10 (WH/BK) and return circuit 9-LE10 (BN/YE). The instrument cluster sends the illumination message to the front electronic module

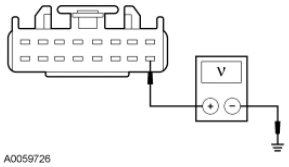
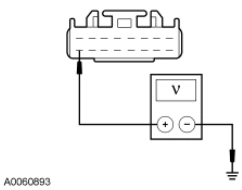
(FEM) over the standard corporate protocol (SCP) communication network, circuits 4-EG8 (GY/VT) and 5-EG8 (BU/WH), based upon the dimmer switch position. The FEM is supplied with illumination voltage through circuit 29S-DK22 (OG/YE) whenever the switched system power (SSP) is energized. When the headlamp switch is in the PARK, HEADLAMP, or AUTOLAMP ON position, the instrument cluster sends the FEM an illumination message and the FEM, in turn, provides a pulse width modulation (PWM) voltage to the interior auxiliary junction box through circuit 64S-LH5 (BU/RD). The interior auxiliary junction box separates the PWM voltage and supplies it to sub-illumination sources through circuits 64S-LH4 (BU/RD), 64S-LH1 (BU/RD), 64S-LK9 (BU/RD), 64S-LH16 (BU/WH), 64S-LK1 (BU/RD), and the central junction box (CJB) through circuit 64S-AD2 (BU/RD). The CJB separates the PWM voltage and also supplies it to the sub-illumination sources through circuits 64S-LH2 (BU/RD) and 64S-LH33 (BU/BK). The sub-illumination sources then provide the PWM voltage to the individual illuminating sources. If the dimmer switch signal and return circuits or the dimmer switch are open, the instrument cluster defaults the FEM to maximum intensity.

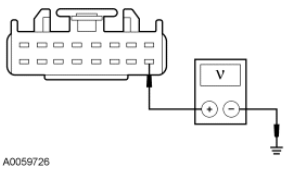
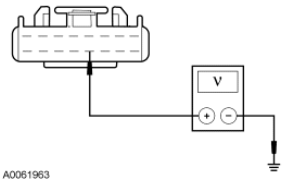
Possible Causes

- circuit 64-LK18 (BU/RD) short to voltage
- circuit 64S-AD2 (BU/RD) short to voltage
- circuit 64S-AH27 (BU) short to voltage
- circuit 64S-AL19 (BU/BK) short to voltage
- circuit 64S-CG15 (BU/WH) short to voltage
- circuit 64S-GG25 (BU/OG) short to voltage
- circuit 64S-LE10 (BU/YE) short to voltage
- circuit 64S-LH1 (BU/RD) short to voltage
- circuit 64S-LH2 (BU/RD) short to voltage
- circuit 64S-LH3 (BU/WH) short to voltage
- circuit 64S-LH4 (BU/RD) short to voltage
- circuit 64S-LH5 (BU/RD) short to voltage
- circuit 64S-LH14 (BU) short to voltage
- circuit 64S-LH15 (BU) short to voltage
- circuit 64S-LH16 (BU/WH) short to voltage
- circuit 64S-LH16A (BU/WH) short to voltage
- circuit 64S-LH26 (BU/BK) short to voltage
- circuit 64S-LH28 (BU) short to voltage
- circuit 64S-LH31 (BU/RD) short to voltage
- circuit 64S-LH32 (BU/RD) short to voltage
- circuit 64S-LH33A (BU/BK) short to voltage
- circuit 64S-LH33 (BU/BK) short to voltage
- circuit 64S-LH42 (BU/RD) short to voltage
- circuit 64S-LH45 (BU/OG) short to voltage
- circuit 64S-LH49 (BU/BK) short to voltage
- circuit 64S-LH50 (BU/YE) short to voltage
- circuit 64S-LK1 (BU/RD) short to voltage
- circuit 64S-LK9 (BU/RD) short to voltage
- circuit 64S-LK11 (BU) short to voltage
- circuit 64S-LK21 (BU/BK) short to voltage
- circuit 64S-LK29 (BU/RD) short to voltage
- circuit 64S-LK34 (BU/BK) short to voltage
- CJB
- interior auxiliary junction box
- joint connector 3
- FEM

PINPOINT TEST C: THE CONTROL ILLUMINATION IS ALWAYS ON

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

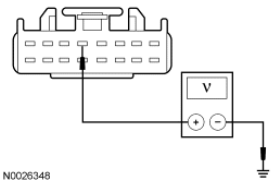
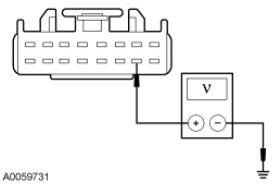
Test Step	Result / Action to Take
C1 CHECK THE OPERATION OF THE FEM	
• Disconnect: FEM C201f. • **Does the illumination go out?**	**Yes** GO to C13 . **No** GO to C2 .
C2 CHECK CIRCUIT 64S-LH5 (BU/RD) FOR A SHORT TO VOLTAGE	
• Disconnect: Interior Auxiliary Junction Box C283a. • Measure the voltage between the interior auxiliary junction box C283a-9, circuit 64S-LH5 (BU/RD), harness side and ground.  A0059726 • **Is any voltage indicated?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to C3 .
C3 CHECK THE INTERIOR AUXILIARY JUNCTION BOX FOR A SHORT TO VOLTAGE	
• Disconnect: Interior Auxiliary Junction Box C283b. • Disconnect: Interior Auxiliary Junction Box C283d. • Measure the voltage between the interior auxiliary junction box C283a pin 9, component side and ground.  A0060893 • **Is any voltage indicated?**	**Yes** REPAIR or INSTALL a new interior auxiliary junction box. TEST the system for normal operation. **No** If the instrument cluster and instrument panel switches remain illuminated, GO to C4 . If the door and window switches remain illuminated, GO to C7 .

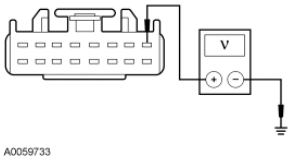
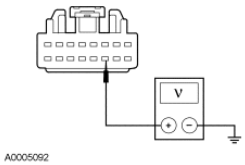
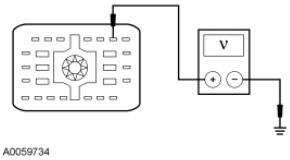
C4 CHECK THE SUPPLY CIRCUIT 64S-LH4 (BU/RD) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the interior auxiliary junction box C283b-9, circuit 64S-LH4 (BU/RD), harness side and ground.  A0059726 • **Is any voltage indicated?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to C5 .
C5 CHECK THE ILLUMINATION SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE	
• Measure the voltage between the interior auxiliary junction box C283a pin 13, component side and ground.  A0061963 • **Is any voltage indicated?**	**Yes** REPAIR or INSTALL a new interior auxiliary junction box. TEST the system for normal operation. **No** GO to C6 .
C6 CHECK THE SUPPLY CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: Joint Connector 3 C224. • Measure the voltage between the joint connector 3 C224, harness side and ground as follows:	**Yes** REPAIR the circuit(s) in question for short to voltage. TEST the system for normal operation. **No** REPAIR or INSTALL a new joint connector 3.

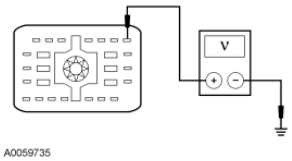
Joint Connector 3	Circuit	Component
C224-16	64-LK18 (BU/RD)	Steering wheel switch
C224-12	64S-LE10 (BU/YE)	Instrument panel dimmer switch
C224-20	64S-LH26 (BU/BK)	Headlamp switch

C224-21	64S-GG25 (BU/OG)	Message center switch
C224-15	64S-LK29 (BU/RD)	Instrument cluster
C224-17	64S-LK34 (BU/BK)	Navigation audio unit
C224-14	64S-AL19 (BU/BK)	Adjustable pedal switch
C224-13	64S-LK1 (BU/RD)	Illumination supply

- **Is any voltage indicated?**

C7 CHECK CIRCUIT 64S-LK9 (BU/RD) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the interior auxiliary junction box C283a-5, circuit 64S-LK9 (BU/RD), harness side and ground.  N0026348 • **Is any voltage indicated?**	**Yes** REPAIR the following circuit(s): 64S-CG15 (BU/WH), 64S-LH3 (BU/WH), 64S-LH45 (BU/OG), 64S-LH49 (BU/BK), 64S-LK9 (BU/RD), 64S-LK11 (BU), or 64S-LK21 (BU/BK) for a short to voltage. TEST the system for normal operation. **No** GO to C8 .
C8 CHECK CIRCUIT 64S-LH16 (BU/WH) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the interior auxiliary junction box C283b-10, circuit 64S-LH16 (BU/WH), harness side and ground.  A0059731 • **Is any voltage indicated?**	**Yes** REPAIR the following circuit(s): 64S-LH16 (BU/WH), 64S-LH16A (BU/WH), or 64S-LH15 (BU) for a short to voltage. TEST the system for normal operation. **No** GO to C9 .
C9 CHECK CIRCUIT 64S-LH1 (BU/RD) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the interior auxiliary junction box C283b-1, circuit 64S-LH1 (BU/RD), harness side and ground.	**Yes** REPAIR the following circuit(s): 64S-LH1 (BU/RD), 64S-LH14 (BU), 64S-AH27 (BU), 64S-LH28 (BU), or 64S-LH50 (BU/YE) for a short to voltage. TEST the system for normal operation.

 A0059733 • **Is any voltage indicated?**	**No** GO to C10 .
C10 CHECK CIRCUIT 64S-AD2 (BU/RD) FOR A SHORT TO VOLTAGE	
• Disconnect: CJB C270d. • Measure the voltage between the interior auxiliary junction box C283b-11, circuit 64S-AD2 (BU/RD), harness side and ground.  A0005092 • **Is any voltage indicated?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to C11 .
C11 CHECK CIRCUIT 64S-LH2 (BU/RD) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the CJB C270d-25, circuit 64S-LH2 (BU/RD), harness side and ground.  A0059734 • **Is any voltage indicated?**	**Yes** REPAIR the following circuit(s): 64S-LH2 (BU/RD), 64S-LH31 (BU/RD), or 64S-LH42 (BU/RD) for a short to voltage. TEST the system for normal operation. **No** GO to C12 .
C12 CHECK CIRCUIT 64S-LH33 (BU/BK) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the CJB C270d-26, circuit 64S-LH33 (BU/BK), harness side and ground.	**Yes** REPAIR the following circuit(s): 64S-LH33 (BU/BK), 64S-LH33A (BU/BK), or 64S-LH32 (BU/RD) for a short to voltage. TEST the system for normal operation. **No** REPAIR or INSTALL a new CJB. TEST the system for normal operation.

 • **Is any voltage indicated?**	
C13 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: The Instrument Cluster Illumination Is Inoperative

Normal Operation

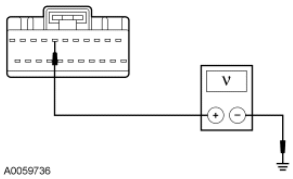
The headlamp switch supplies the instrument cluster with the headlamp switch position status. For additional information on the headlamp switch operation, refer to Section 417-01 . The dimmer switch provides the instrument cluster with the dimmer control status through signal circuit 8-LE10 (WH/BK) and return circuit 9-LE10 (BN/YE). The instrument cluster sends the illumination message to the front electronic module (FEM) over the standard corporate protocol (SCP) communication network, circuits 4-EG8 (GY/VT) and 5-EG8 (BU/WH), based upon the dimmer switch position. The FEM is supplied with illumination voltage through circuit 29S-DK22 (OG/YE) whenever the switched system power (SSP) is energized. When the headlamp switch is in the PARK, HEADLAMP, or AUTOLAMP ON position, the instrument cluster sends the FEM an illumination message and the FEM, in turn, provides a pulse width modulation (PWM) voltage to the interior auxiliary junction box through circuit 64S-LH5 (BU/RD). The interior auxiliary junction box separates the PWM voltage and supplies it to joint connector 3 through circuit 64S-LK1 (BU/RD) and from joint connector 3 to the instrument cluster through circuit 64S-LK29 (BU/RD). The instrument cluster is grounded by circuit 31-A11 (BK).

Possible Causes
- instrument cluster
- circuit 31-A11 (BK) open
- circuit 64S-LK29 (BU/RD) open or short to ground

PINPOINT TEST D: THE INSTRUMENT CLUSTER ILLUMINATION IS INOPERATIVE

⚠ **CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
D1 CHECK THE ILLUMINATION FEED CIRCUIT FOR VOLTAGE	

• Disconnect: Instrument Cluster C220a. • Ignition ON. • Turn the headlamp switch ON. • Place the dimmer switch in the maximum brightness position. • Measure the voltage between the instrument cluster C220a-7, circuit 64S-LK29 (BU/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to D2 . **No** REPAIR the circuit. TEST the system for normal operation.
D2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Instrument Panel Illumination Does Not Dim

Normal Operation

The headlamp switch supplies the instrument cluster with the headlamp switch position status. For additional information on the headlamp switch operation, refer to Section 417-01 . The dimmer switch provides the instrument cluster with the dimmer control status through signal circuit 8-LE10 (WH/BK) and return circuit 9-LE10 (BN/YE). The instrument cluster sends the illumination message to the front electronic module (FEM) over the standard corporate protocol (SCP) communication network, circuits 4-EG8 (GY/VT) and 5-EG8 (BU/WH), based upon the dimmer switch position. The FEM is supplied with illumination voltage through circuit 29S-DK22 (OG/YE) whenever the switched system power (SSP) is energized. When the headlamp switch is in the PARK, HEADLAMP, or AUTOLAMP ON position, the instrument cluster sends the FEM an illumination message and the FEM, in turn, provides pulse width modulation (PWM) voltage to the interior auxiliary junction box through circuit 64S-LH5 (BU/RD). The interior auxiliary junction box separates the PWM voltage and supplies it to sub-illumination sources through circuits 64S-LH4 (BU/RD), 64S-LH1 (BU/RD), 64S-LK9 (BU/RD), 64S-LH16 (BU/WH), 64S-LK1 (BU/RD), and the central junction box (CJB) through circuit 64S-AD2 (BU/RD). The CJB separates the PWM voltage and also supplies it to sub-illumination sources through circuits 64S-LH2 (BU/RD) and 64S-LH33 (BU/BK). The sub-illumination sources then provide the PWM voltage to the individual illuminating sources.

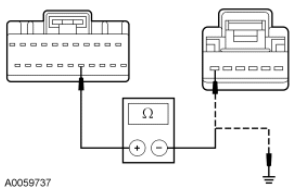
Possible Causes

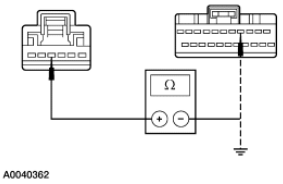
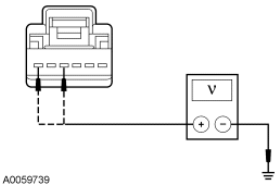
- circuit 8-LE10 (WH/BK) open, short to voltage, or short to ground
- circuit 9-LE10 (BN/YE) open, short to voltage, or short to ground
- instrument panel dimmer switch

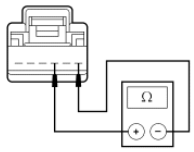
- instrument cluster

PINPOINT TEST E: THE INSTRUMENT PANEL ILLUMINATION DOES NOT DIM

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
E1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs) FROM THE INSTRUMENT CLUSTER	
• Check the recorded results from the instrument cluster self-test. • **Is DTC B1246 present?**	**Yes** GO to E3 . **No** GO to E2 .
E2 CHECK THE INSTRUMENT PANEL DIMMER SWITCH — MONITOR THE INSTRUMENT CLUSTER PID	
• Ignition ON. • Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster PID • Turn the headlamp switch ON. • Select and monitor the instrument cluster PID DSWSTAT while rotating the instrument panel dimmer switch from the lowest position to the highest position. • **Does the PID value agree with the instrument panel dimmer switch position?**	**Yes** GO to E7 . **No** GO to E3 .
E3 CHECK CIRCUIT 8-LE10 (WH/BK) FOR AN OPEN OR A SHORT TO GROUND	
• Ignition OFF. • Turn the headlamp switch OFF. • Disconnect: Instrument Panel Dimmer Switch C206. • Disconnect: Instrument Cluster C220c. • Measure the resistance between the instrument cluster C220c-16, circuit 8-LE10 (WH/BK), harness side and the instrument panel dimmer switch C206-6, circuit 8-LE10 (WH/BK), harness side and; and between the instrument cluster C220c-16, circuit 8-LE10 (WH/BK), harness side and ground.  • **Is the resistance less than 5 ohms between the instrument cluster and the instrument panel dimmer switch, and greater than 10,000 ohms between the instrument cluster and ground?**	**Yes** GO to E4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

E4 CHECK CIRCUIT 9-LE10 (BN/YE) FOR AN OPEN OR A SHORT TO GROUND	
• Measure the resistance between the instrument panel dimmer switch C206-4, circuit 9-LE10 (BN/YE), harness side and the instrument cluster C220c-4, circuit 9-LE10 (BN/YE), harness side; and between the instrument panel dimmer switch C206-4, circuit 9-LE10 (BN/YE), harness side and ground.  A0040362 • **Is the resistance less than 5 ohms between the instrument panel dimmer switch and instrument cluster, and greater than 10,000 ohms between the instrument panel dimmer switch and ground?**	**Yes** GO to E5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E5 CHECK CIRCUITS 8-LE10 (WH/BK) AND 9-LE10 (BN/YE) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the instrument panel dimmer switch C206-6, circuit 8-LE10 (WH/BK), harness side and ground; and between the instrument panel dimmer switch C206-4, circuit 9-LE10 (BN/YE), harness side and ground.  A0059739 • **Is any voltage indicated?**	**Yes** REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to E6 .
E6 CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
• Ignition OFF. • While rotating the instrument panel dimmer switch from the minimum brightness level to the maximum brightness level, measure the resistance between the instrument panel dimmer switch C206 pin 4, component side and the instrument panel dimmer switch C206 pin 6, component side.	**Yes** GO to E8 . **No** INSTALL a new instrument panel dimmer switch. REFER to Instrument Panel Dimmer Switch in this section. CLEAR the DTCs. REPEAT the self-test.

 N0027599 • **Does the resistance begin at approximately 1,000 ohms at the minimum brightness level and move to approximately 10 megaohms at the maximum brightness level?**	
E7 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

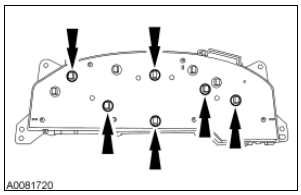
E8 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Instrument Cluster Bulb

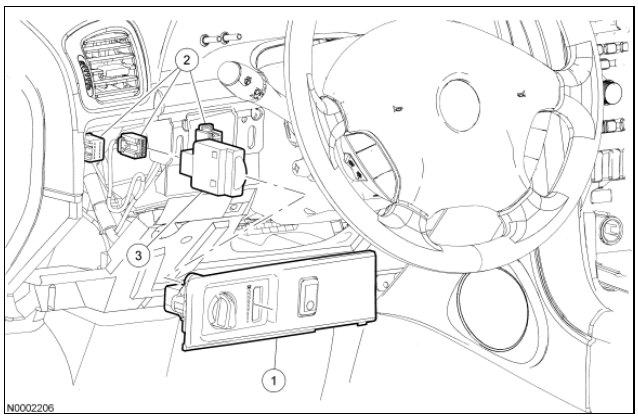
Removal and Installation

1. Remove the instrument cluster. For additional information, refer to Section 413-01 .
2. Remove the instrument cluster socket and bulb assembly, as necessary.



3. To install, reverse the removal procedure.

Instrument Panel Dimmer Switch



Item	Part Number	Description
1	044B89	Outer instrument panel finish panel
2	—	Headlamp switch and instrument panel dimmer switch electrical connectors (Part of 14401)
3	13K196	Instrument panel dimmer switch

1. Remove the instrument panel steering column cover. For additional information, refer to Section 501-12 .

2. **NOTE:** The outer instrument panel finish panel is held in place by spring clips located on the housing.

   Remove the outer instrument panel finish panel.

   - Disconnect electrical connectors.

3. Release the retaining tabs and remove the instrument panel dimmer switch.

4. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft
Steering column nuts	17	13

Instrument Cluster (IC)

The base and optional instrument clusters both contain gauges, indicator lamps, and warning lamps that are designed to provide the driver with system status and to alert the driver that certain conditions exist in the vehicle. The optional instrument cluster contains the message center which is located in the lower RH corner of the cluster. Gauges provide information to the driver indicating the status of systems. The systems that use gauges include vehicle speed, fuel level, engine coolant temperature, and engine rpm. Indicator lamps provide information to the driver of conditions that exist in the vehicle. Examples of the indicator lamps include the turn signal, low washer fluid level, traction control, and speed control lamps. Warning indicator lamps provide information to the driver of conditions that could potentially alter vehicle performance. Examples of the warning indicators include the ABS, BRAKE, safety belt, and low oil pressure indicators.

Information And Message Center

The message center display is a green vacuum fluorescent, fixed format display. The message center display is integral to the instrument cluster. The message center is controlled by the 4 message center switches (FUEL, RESET, STATUS, and SETUP).

Warning Chimes

The instrument cluster controls the warning chime function. The warning chime sounds to remind the driver:

- to turn the headlamps off when exiting the vehicle.
- to remove the ignition key when exiting the vehicle.
- to close the doors/decklid after starting the vehicle.
- to fasten the safety belt after the vehicle is started.
- to disengage the parking brake when driving the vehicle.
- to turn off the turn signal.

The instrument cluster uses various inputs to determine when to sound the warning chime. The warning chime sounds:

- if the headlamps are left on with the ignition switch in the OFF position and the driver door is ajar.
- if the key is in the ignition in the OFF position and the driver door is ajar.
- if a door/decklid is ajar while the ignition switch is in the RUN position.
- if the safety belts are not fastened and the ignition switch is in the RUN position.
- if the parking brake is engaged and the vehicle is in motion.
- if the turn signal is left on for more than 0.8Â km (0.5Â mile).
- if the air bag warning indicator is inoperative when there are diagnostic trouble codes (DTCs) present.
- if the engine has reached an over-temperature condition.

Instrumentation, Message Center and Warning Chimes

Principles of Operation

NOTE: The instrument cluster, the front electronic module (FEM), and the rear electronic module (REM) must be reconfigured upon replacement. Refer to Section 418-01 .

NOTE: The diagnostic tool may display ICM for the instrument cluster.

NOTE: For any concerns with the restraints control module (RCM), refer to Section 501-20B .

The instrument cluster is a hybrid electronic instrument cluster (HEC) with the message center integrated into the instrument cluster. The vehicle electronic functions are divided into zones. The instrument cluster, FEM, and REM use the standard corporate protocol (SCP) communication network to transmit and receive information. The message center communicates with the powertrain control module (PCM), the front electronic module (FEM), the rear electronic module (REM), and the anti-lock brake system (ABS) module over the communication network. The instrument cluster communicates with the FEM, the REM, the anti-lock brake system (ABS) module, the powertrain control module (PCM), the steering column lock, the message center, and the RCM over the SCP to control the gauges, indicators, and chimes. It is very important to understand:

- where the input (command) originates
- all information (messages) necessary in order for a feature to operate
- which module(s) receive(s) the input or command message
- does the module which received the input (message) control the output of the feature, or does it output a message over the SCP communication network to another module
- which module controls the output of the feature

The instrument cluster communicates with the FEM, the REM, the anti-lock brake system (ABS) module, the powertrain control module (PCM), the steering column lock, the message center, and the RCM over the SCP to control the gauges, indicators, and chimes.

Instrument Cluster

Integrated Circuit Display

The integrated circuit display maintains 3 separate functions housed in a single display area: the warning center display, the trip A/B, and the odometer display.

Warning Center Display

The warning center display is a fluorescent vacuum tube display that alerts the driver of a lamp outage or an electric parking brake condition. The FEM and REM both control the exterior illumination. When an exterior lamp(s) is inoperative, the FEM or the REM notifies the instrument cluster over the communication network, and the instrument cluster illuminates the warning center message LAMP OUT. The warning center message remains on until the condition is corrected. When the electric parking brake is applied, needs to be recalibrated, or has a system fault, the electric parking brake module notifies the instrument cluster over the

communication network. Once the condition is corrected, the warning center displays the trip odometer.

Trip A/B And Odometer Displays

The rolling count data is sent to the instrument cluster from the powertrain control module (PCM) over the SCP communication network.

PRNDL Display

The digital transmission range (TR) sensor is hardwired directly to the PCM. The status of the gear selection is sent to the instrument cluster from the PCM over the communication network.

Fuel Gauge

The fuel gauge system has a saddle-type fuel tank with 2 integrated fuel senders: the fuel pump module and the remote fuel sender. The fuel pump module is located on the right side of the fuel tank, and the remote fuel sender is located on the left side of the fuel tank. The fuel level status is sent directly to the REM, which is hardwired to the fuel senders. The REM sends the fuel data to the instrument cluster via the communication network. Normal operating range of the fuel senders is 15 ± 2 ohms at empty (E) to 160 ± 4 ohms at full (F).

NOTE: The fuel pump module may also be called the fuel delivery module or fuel tank unit. The remote fuel sender may also be called the fuel transfer pump, jet pump module or fuel sender.

The instrument cluster uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Key OFF fueling
- Key ON fueling
- Recovery

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

The default fuel gauge mode is called the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel sender readings caused by fuel moving around in the tank), the fuel gauge takes approximately 55 minutes to go from empty (E) to full (F).

The key OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The key must be in the OFF position when refueling the vehicle.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.
- The instrument cluster must receive a valid key ON fuel sender reading within 1 second of the key being put into the RUN position. The key ON sample readings are considered valid if the fuel sender reading is between 15 ohms ± 2 ohms and 160 ohms ± 4 ohms.

If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

The key ON fueling mode (approximately 90 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The transmission is in PARK (P) (automatic transmissions) or the parking brake is applied (manual transmissions).
- The key is in the RUN position.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.

In key ON fueling mode, a 30-second timer activates after the transmission is put into the PARK (P) position (automatic transmissions) or when the parking brake is applied (manual transmissions). When the 30-second time has elapsed and at least 15% of the vehicle's fuel capacity has been added, the fuel gauge response time is 90 seconds to read from empty (E) to full (F). When the transmission is shifted out of PARK (P) (automatic transmissions), or the parking brake is released (manual transmissions), the fuel gauge strategy reverts to the anti-slosh mode. The key ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the key in the RUN position.

Recovery mode is incorporated into the instrument cluster strategy to recover from a missing fuel level input after a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sender or its circuits. Recovery mode (empty [E] to full [F] approximately 20 minutes) is initiated when the following 2 conditions are met:

- The instrument cluster is in the anti-slosh (default) mode.
- The actual fuel level in the tank is greater than what is being displayed by the fuel gauge.

Speedometer Gauge

Vehicle speed information is sent to the instrument cluster by the PCM over the communication network. The PCM calculates vehicle speed from the transmission output shaft speed (OSS) sensor input.

Tachometer Gauge

The instrument cluster uses crankshaft speed information, sent to the PCM from the crankshaft position sensor, to control the movement of the tachometer pointer. The crankshaft position sensor is hardwired directly to the PCM, which provides the crankshaft position sensor status to the instrument cluster over the communication network.

Temperature Gauge

The cylinder head temperature sensor is hardwired directly to the PCM. The status of the cylinder head temperature is sent from the PCM over the communication network to the instrument cluster.

Air Bag Warning Indicator

The supplemental restraints system is monitored and controlled by the RCM. The status of the supplemental restraints system is sent from the RCM to the instrument cluster through hardwired circuitry. The AIR BAG warning indicator is illuminated if the RCM sends a ground signal to the instrument cluster.

ABS Warning Indicator

The ABS is monitored by the ABS module, which sends the status signal to the instrument cluster over the communication network. The instrument cluster uses this input to determine whether or not there is a fault with the traction control or the ABS systems, and illuminates the ABS warning indicator according to the input.

Brake Warning Indicator

The brake warning indicator uses 3 separate functions: base brake system failure, low brake fluid level, and engagement of the parking brake. These functions are controlled by the parking brake control switch, the brake fluid level switch, and the brake system itself. The brake fluid level switch is hardwired directly to the FEM. The status of the brake fluid level switch is sent from the FEM to the instrument cluster over the communication network. The parking brake control switch is hardwired directly to the parking brake module. The status of the parking brake switch is sent from the parking brake module to the instrument cluster over the communication network. The base brake system status is monitored by the ABS module and sent to the instrument cluster over the communication network.

Charging System Warning Indicator

The charging system controls are accomplished through the PCM, which monitors the output of the generator through hardwired circuitry. The status of the charging system is then relayed from the PCM to the instrument cluster over the communication network.

Door Ajar Warning Indicator (Base Cluster Only)

The rear door switches and the decklid ajar switch are directly hardwired to the REM. The door switches for the front of the vehicle are directly hardwired to the FEM. The FEM and REM both use the multiple inputs from the door switches and the decklid ajar switch to determine whether the doors and the decklid ajar switch are in the opened or closed position. The door ajar status is sent to the instrument cluster from both the FEM and REM over the communication network.

Engine Over-Temperature Warning Indicator

The engine over-temperature status is determined by the cylinder head temperature sensor, which is hardwired directly to the PCM. The status of the cylinder head temperature is sent from the PCM over the communication network to the instrument cluster. The instrument cluster then determines whether or not the cylinder head temperature is above the over-temperature threshold.

Low Fuel Warning Indicator (Base Cluster Only)

There are 2 fuel tank senders, which are hardwired directly to the REM. The status of the fuel level from both senders is sent from the REM over the communication network to the instrument cluster. The instrument cluster uses these inputs to determine the overall fuel level in the tank and illuminates the low fuel warning indicator if the fuel level is low.

Low Washer Fluid Warning Indicator (Base Cluster Only)

The low washer fluid level switch is hardwired directly to the FEM. The FEM monitors the washer fluid level status and sends it to the instrument cluster via the communication network.

Safety Belt Warning Indicator

The instrument cluster receives the safety belt warning status from the RCM through hardwired circuitry. The safety belt switch is hardwired to the RCM. When the safety belt is fastened, the safety belt switch opens and removes the ground to the RCM. When the safety belt is unfastened, the safety belt switch closes and grounds the circuit to the RCM.

Advance Traction Indicator

The status of the advance traction control system is communicated to the instrument cluster from the ABS module over the communication network. When a traction control event occurs the ABS module sends a command to the instrument cluster to illuminate the advance traction indicator.

CHECK FUEL CAP (Base Cluster Only)

The CHECK FUEL CAP indicator is used to indicate significant leaks in the fuel tank evaporative system due to a loose fuel cap. The fuel tank pressure is monitored by the PCM, and if a leak is detected it signals a fault to the instrument cluster over the communication network. Once the PCM has detected a loose fuel cap and the CHECK FUEL CAP indicator is illuminated, the indicator remains illuminated until the fuel cap is secured and the ignition switch has been cycled one time.

Powertrain Malfunction (Wrench) (Base Cluster Only)

The instrument cluster receives the powertrain malfunction (wrench) status from the PCM over the communication network. When a system concern is detected, the PCM sends the instrument cluster a command signal to illuminate the powertrain malfunction (wrench).

High Beam Indicator

The multifunction switch is hardwired directly to the instrument cluster. The headlamp status is then sent from the instrument cluster to the FEM via the communication network.

Low Oil Pressure Indicator

The low oil pressure switch is hardwired to the FEM. The status of the oil pressure is sent from the FEM to the instrument cluster via the communication network.

Malfunction Indicator Lamp (MIL)

After the engine is started, the MIL proves out for a duration of 3 seconds. If the instrument cluster does not receive a message from the PCM within 5 seconds, it sends 2 messages to the PCM and attempts to reestablish communication. If the instrument cluster is unable to reestablish communication, the instrument cluster illuminates the MIL and logs a diagnostic trouble code (DTC).

Speed Control Indicator

The speed control status is monitored by the PCM and then relayed to the instrument cluster via the communication network. The speed control indicator illuminates when the speed control is set.

Steering Column Lock Indicator (If Equipped)

The instrument cluster monitors the key-in-ignition status, the ignition switch position status, and the steering column lock status. When the key is in the ignition switch, the ignition switch is in the RUN position and the steering column is locked, the instrument cluster turns on the steering column lock warning indicator. The steering column lock status is sent to the instrument cluster from the steering column lock module over the communication network.

Traction Control Indicator

The status of the traction control is communicated to the instrument cluster from the ABS module via the communication network. When the traction control system is active, the ABS module sends a command to the instrument cluster to illuminate the traction control indicator.

Turn/Hazard Indicator

The multifunction switch is hardwired directly to the instrument cluster. The instrument cluster sends the signal from the multifunction switch to both the FEM and the REM via the communication network while simultaneously illuminating the turn/hazard indicators. The FEM and the REM use these inputs from the instrument cluster to illuminate the exterior lighting as necessary.

Information And Message Center

Display Information

The display modes are:

- fuel (average fuel economy, distance to empty)
- setup
- system status
- warning
- temporary alert

The message center information can be selected by pressing any of the following 4 buttons:

- FUEL
- RESET
- SETUP
- STATUS

The setup display and the status display times-out and defaults to the fuel blank display function. The temporary alert display interrupts the current display to show the status of an event that has just happened. The warning display interrupts the current display until cleared or reset by the driver.

Status Displays

The status displays are timed modes and default back to the fuel blank display function. The status display modes are:

- oil life %
- AC air filter life %
- charging system
- low oil
- engine temperature
- brake fluid level
- washer fluid level
- driver door
- passenger door
- driver rear door
- passenger rear door
- luggage compartment lid
- headlamps
- front turn lamps
- side repeater lamps
- rear turn lamps
- stoplamps
- tail lamps
- traction control
- advance trac

Setup Displays

The setup displays are timed modes and default back to the fuel blank display function. The setup display modes are:

- English/metric units
- autolocks on, autolocks off
- easy exit seat on, easy exit seat off
- autolamp delay
- lock chirp on, lock chirp off
- language

Warning Messages

The warning messages can interrupt the display until cleared or reset by the driver. The warning messages are single cycle, non-resettable, and repetitive warning messages. The single cycle warning messages are:

- change oil now (0%)
- change oil soon (1%-5%)
- low oil level
- low washer fluid level
- low brake fluid level
- check headlamps
- check brake lamps
- check tail lamps
- check front turn lamps
- check rear turn lamps
- change A/C air filter soon
- luggage compartment lid
- check fuel cap
- service park brake
- apply park brake

The single cycle warning messages display once whenever the ignition switch is turned to the ON position or a fault occurs in a system and is cleared by pressing the RESET button.

The repetitive warning messages are:

- check charging system
- low fuel level
- check transmission
- transmission overheated

The repetitive warning messages are displayed at a fixed interval whenever the ignition switch is turned to the ON position or the ACC position. To remove a repetitive warning message, press the RESET button. The message recurs after 10 minutes or until the warning condition is corrected.

The non-resettable warning messages display whenever the ignition switch is turned to the ON position and a fault occurs in a system. The fault must be corrected to clear the non-resettable warning messages.

The non-resettable warning messages are:

- stop engine safely
- driver door ajar
- passenger door ajar
- driver rear door ajar
- passenger rear door ajar
- decklid ajar switch
- park brake on
- powertrain malfunction (wrench)-engine failsafe mode

Temporary Alert Messages

The temporary alert display interrupts the current display to show the status of an event that has just happened. The temporary alert messages are:

- autolamp delay

- memory recall/save
- traction control
- advance trac
- speed control ON/OFF status

Warning Chimes

The instrument cluster controls the warning chime function. The warning chime sounds to remind the driver:

- to turn the headlamps off when exiting the vehicle.
- to remove the ignition key when exiting the vehicle.
- to close the doors/decklid after starting the vehicle.
- to fasten the safety belt after the vehicle is started.
- to disengage the parking brake when driving the vehicle.
- to turn off the turn signal.

The instrument cluster uses various inputs to determine when to sound the warning chime. The warning chime sounds:

- if the headlamps are left on with the ignition switch in the OFF position and the driver door is ajar.
- if the key is in the ignition in the OFF position and the driver door is ajar.
- if a door/decklid is ajar while the ignition switch is in the RUN position.
- if the safety belts are not fastened and the ignition switch is in the RUN position.
- if the parking brake is engaged and the vehicle is in motion.
- if the turn signal is left on for more than 0.8Â km (0.5Â mile).
- if the air bag warning indicator is inoperative when there are diagnostic trouble codes (DTCs) present.
- if the engine has reached an over-temperature condition.

The instrument cluster uses different types of sounds to alert the driver of various vehicle conditions as follows:

- driver or passenger safety belt not fastened warning (chime times out)
- key-in-ignition warning (repetitive chime)
- headlamp on warning (repetitive chime)
- door ajar warning (repetitive chime)
- safety belt warning (repetitive chime)
- Belt-Minder® warning (repetitive chime after a delay and after the safety belt warning chime has completed)
- fail safe cooling warning (repetitive chime)
- turn signal warning (repetitive chime)
- airbag warning chime (single chime)
- electronic parking brake warning (single chime)

Safety Belt Warning Chime

The safety belt warning chime warns that the safety belt is not fastened. The safety belt warning chime sounds when the driver or passenger safety belt is not fastened and the ignition lock cylinder is turned from the OFF/LOCK or ACC position to the RUN or START position.

The safety belt warning chime stops sounding when the safety belt is fastened, when the ignition lock cylinder is switched from the RUN or START position to the OFF/LOCK or ACC position, or when the chime has sounded for approximately 6 seconds.

The safety belt warning chime inputs are:

- ignition switch in the START position
- ignition switch in the RUN position
- driver or passenger safety belt switch data communicated by the restraints control module (RCM) to the instrument cluster on circuit 8-GE52 (WH/BK)

Belt-Minder®

The Belt-Minder® is configurable. For additional information, refer to Section 418-01 . To configure without using a diagnostic tool, refer to Belt-Minder® Deactivating/Activating in this section.

The Belt-Minder® feature supplements the current safety belt warning function. The Belt-Minder® is enabled after the current safety belt warning is complete. The Belt-Minder® reminds the driver that the driver or passenger safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the instrument cluster. While activated, the Belt-Minder® alternates the chime and indicator from on for 6 seconds to off for 30-seconds.

Door Ajar Warning Chime

The door ajar warning chime warns that a door is not fully closed. The chime sounds when any door or the luggage compartment lid becomes ajar while the ignition switch is in the RUN position.

The door ajar warning chime inputs are:

- ignition switch in the START position
- ignition switch in the RUN position
- door ajar data communicated by the front electronic module (FEM) and the rear electronic module (REM) to the instrument cluster on the communication network

Key-In-Ignition Warning Chime

The key-in-ignition warning chime sounds when the driver door is ajar and the key is in the ignition lock cylinder.

The key-in-ignition warning chime stops sounding when the driver door is closed or the key is removed from the ignition lock cylinder.

The key-in-ignition warning chime inputs are:

- the key-in-ignition switch circuit 30S-GM7 (RD/WH), voltage applied with the key in the ignition lock cylinder.
- ignition switch in the START position
- ignition switch in the RUN position
- door ajar data communicated by the FEM and the REM to the instrument cluster on the communication network

Headlamps On Warning Chime

The headlamps on warning chime warns that the headlamps are on when the driver door is ajar and the key is removed from the ignition lock cylinder. The headlamps on warning chime sounds if the driver door is ajar, the headlamp switch is in the on position, and the ignition lock cylinder is in the OFF/LOCK position with the key out.

The headlamps on warning chime stops sounding when any one of the above conditions are removed.

The headlamps on warning chime inputs are:

- ignition switch in the START position
- ignition switch in the RUN position
- key-in-ignition switch circuit 30S-GM7 (RD/WH), no voltage applied with the key removed from the ignition lock cylinder

Air Bag Warning Chime

The air bag warning chime warns the driver that the air bag warning indicator lamp is inoperative.

The air bag warning chime inputs are:

- ignition switch in the RUN position
- air bag warning chime request from the RCM

Electronic Parking Brake Warning Chime

The electronic parking brake warning chime reminds the driver that the parking brake is engaged by intermittently sounding a chime and illuminating the brake warning indicator in the instrument cluster once the vehicle speed exceeds 4 km/h (3 mph).

The electronic parking brake warning chime inputs are:

- parking brake applied signal from the electronic parking brake module
- vehicle speed signal from the powertrain control module (PCM)

Turn Signal Warning Chime

The turn signal warning chime sounds when the vehicle is driven in excess of 0.8Â km (0.5Â mile) with the right or left turn signal active continuously.

Fail-Safe Cooling Warning Chime

The fail-safe cooling mode has 2 levels of operation, which are transmitted from the PCM over the communication network to the instrument cluster. When the engine coolant temperature reaches an over-temperature condition, the PCM provides a level 1 over-temperature signal to the instrument cluster. The instrument cluster positions the temperature gauge in the HOT range, illuminates the over-temperature warning indicator, oil pressure warning indicator, and malfunction indicator lamp (MIL). The instrument cluster also provides an intermittent chime, consisting of 3 tones within a 2-second interval. If the over-temperature continues to increase, the PCM provides the instrument cluster with a level 2 over-temperature signal and the intermittent chime strategy sounds 5 tones within a 2-second interval.

Parameter Reset and Key Programming

To reset the instrument cluster parameters and program the keys, complete the following procedure:

NOTE: The instrument cluster parameters must be reset upon installation of a new instrument cluster.

NOTE: Both passive anti-theft system (PATS) keys are needed to carry out this procedure.

NOTE: If the vehicle fails to start following completion of the parameter reset and key programming sequence, clear the keep alive memory (KAM) by disconnecting the battery for 5 minutes. For additional information about the battery disconnect procedure, refer to Section 414-01 .

1. Connect the diagnostic tool.

2. Select the instrument cluster.
3. Select ENTER SECURITY ACCESS. Wait 10 minutes for security access to be granted.
4. Select PARAMETER RESET.
5. Disconnect the diagnostic tool.
6. Place the first PATS key in the ignition switch.
7. Turn the ignition switch to the ON position.
8. Turn the ignition switch to the OFF position.
9. Remove the key from the ignition switch.
10. Place the second PATS key in the ignition switch.
11. Turn the ignition switch to the ON position.
12. Turn the ignition switch to the OFF position (the programming sequence is complete).

Inspection and Verification

NOTE: For any concerns with the restraints control module (RCM), refer to Section 501-20B .

NOTE: A new instrument cluster and FEM must be reconfigured upon installation. Refer to Section 418-01 .

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Accessory drive belt • Brake fluid level • Engine coolant level • Engine oil level • Fuel tank • Washer fluid level	• Central junction box (CJB) fuse(s): ♦ 4 (5A) ♦ 13 (5A) ♦ 17 (5A) ♦ 19 (15A) ♦ 20 (10A) • Battery junction box (BJB) fuse 22 (20A) • Circuitry • Front electronic module (FEM) • Instrument cluster • Key-in-ignition switch (part of the ignition switch) • Parking brake module • Powertrain control module (PCM)

	• Rear electronic module (REM) • Restraints control module (RCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for the instrument cluster, GO to Pinpoint Test A .
   - No response/not equipped for the parking brake module, refer to Section 206-05 .
   - No response/not equipped for the FEM, refer to Section 419-10 .
   - No response/not equipped for the REM, refer to Section 419-10 .
   - No response/not equipped for the RCM, refer to Section 501-20B .
   - No response/not equipped for the PCM, refer to Section 418-00 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Instrument Cluster Diagnostic Trouble Code (DTC) Index, Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index, Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index, Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Index, or the Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index. For the electronic brake control module DTCs, refer to Section 206-05 . For all other DTCs, refer to Section 419-10 .

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart - Instrument Cluster , GO to Symptom Chart - Information And Message Center or GO to Symptom Chart - Warning Chimes .

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B1202	Fuel Sender Circuit Open	GO to Pinpoint Test B .
B1204	Fuel Sender Circuit Short to Ground	GO to Pinpoint Test B .
B1205	EIC Switch-1 Assembly Circuit Failure	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
B1209	EIC Switch-2 Assembly Circuit Failure	GO to Pinpoint Test AC .

B1317	Battery Voltage High	REFER to Section 414-00 .
B1318	Battery Voltage Low	REFER to Section 414-00 .
B1342	ECU Is Defective	CLEAR and DOCUMENT the DTCs. CARRY OUT the instrument cluster self-test. INSTALL a new instrument cluster if DTC B1342 is retrieved again. REFER to Instrument Cluster (IC) in this section.
B1352	Ignition Key-In Circuit Failure	GO to Pinpoint Test AM .
B1567	Lamp Headlamp High-Beam Circuit Failure	REFER to Section 417-01 .
B2143	NVM Memory Failure	GO to Pinpoint Test Z .
B2627	Fuel Sender Circuit Open #2	GO to Pinpoint Test B .
B2628	Fuel Sender Circuit Short to Ground #2	GO to Pinpoint Test B .
B2879	Fuel Tank Jet Pump Fault	GO to Pinpoint Test B .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	REFER to Section 418-00 .
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant Fluid Temperature	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1123	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	REFER to Section 418-00 .
U1262	SCP (J1850) Communication Bus Fault	REFER to Section 418-00 .
All Other DTCs	—	REFER to Section 419-10 .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	GO to Pinpoint Test N (base cluster) or GO to Pinpoint Test AF (message center cluster).
C1284	Engine Oil Pressure Switch Failure	GO to Pinpoint Test J .
All other DTCs	—	REFER to Section 419-10 .

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
P0457	Fuel Fill Cap Off	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis of the DTC.

P0460	Fuel Level Sensor A Circuit	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0461	Fuel Level Sensor A Circuit Range/Performance	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0462	Fuel Level Sensor A Circuit Low	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0463	Fuel Level Sensor A Circuit High	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P2065	Fuel Level Sensor B Circuit	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P2066	Fuel Level Sensor B Circuit Range/Performance	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P2067	Fuel Level Sensor B Circuit Low	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P2068	Fuel Level Sensor B Circuit High	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
All other DTCs	—	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B1869	Lamp Air Bag Warning Indicator Circuit Open	GO to Pinpoint Test W .
B1870	Lamp Air Bag Warning Indicator Circuit Short to Battery	GO to Pinpoint Test W .
All other DTCs	—	REFER to Section 501-20B .

Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B1201	Fuel Sender Circuit Failure	GO to Pinpoint Test B .
All other DTCs	—	REFER to Section 419-10 .

Symptom Charts

Symptom Chart — Instrument Cluster

Symptom Chart — Information and Message Center

Symptom Chart — Warning Chimes

Pinpoint Tests

Pinpoint Test A: No Communication With The Instrument Cluster

Normal Operation

The instrument cluster communicates interactively with other electronic modules using the communication network. For additional information on module communication, refer to Section 418-00 . With the ignition switch in the START or RUN position, the instrument cluster receives voltage from the central junction box (CJB) through circuits 15-GG14 (GN/RD) and 15-JA14 (GN/BK). When the ignition switch is in the RUN or ACC position, voltage is received from the CJB through circuit 75-GG15 (YE/GN). With the ignition switch in the OFF position, the instrument cluster receives its keep-alive voltage from the CJB through circuits 29-GG11 (OG/BU), and 29-AL12 (OG). The instrument cluster grounding is accomplished through circuit 91-GG11 (BN/RD), and circuit 31-AL11 (BK).

Possible Causes

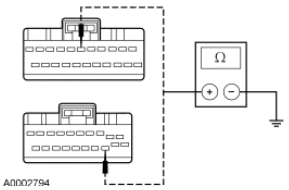
- fuse(s)
- circuit 15-GG14 (GN/RD) open
- circuit 15-JA14 (GN/BK) open
- circuit 29-AL12 (OG) open
- circuit 29-GG11 (OG/BU) open
- circuit 31-AL11 (BK) open
- circuit 75-GG15 (YE/GN) open
- circuit 91-GG11 (BN/RD) open
- instrument cluster

PINPOINT TEST A: NO COMMUNICATION WITH THE INSTRUMENT CLUSTER

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
A1 CHECK THE INSTRUMENT CLUSTER VOLTAGE SUPPLY	

<table>
<tr><td>
• Ignition OFF.
• Disconnect: Instrument Cluster C220a, C220b.
• Ignition ON.
• Measure the voltage between the instrument cluster, harness side and ground as follows:
<table>
<tr><th>Instrument Cluster Connector-Pin</th><th>Circuit</th></tr>
<tr><td>C220a-1</td><td>29-AL12 (OG)</td></tr>
<tr><td>C220a-11</td><td>15-JA14 (GN/BK)</td></tr>
<tr><td>C220b-3</td><td>29-GG11 (OG/BU)</td></tr>
<tr><td>C220b-6</td><td>15-GG14 (GN/RD)</td></tr>
<tr><td>C220b-17</td><td>75-GG15 (YE/GN)</td></tr>
</table>
• Is the voltage greater than 10 volts?
</td><td>Yes
GO to A2 .

No
VERIFY the CJB fuses, 4 (5A), 13 (5A), 17 (5A), 19 (15A) and 20 (10A) are OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.</td></tr>
<tr><td>A2 CHECK CIRCUITS 31-AL11 (BK) AND 91-GG11 (BN/RD) FOR AN OPEN</td><td></td></tr>
<tr><td>
• Ignition OFF.
• Measure the resistance between the instrument cluster C220b-13, circuit 91-GG11 (BN/RD), harness side and ground; and between the instrument cluster C220a-6, circuit 31-AL11 (BK), harness side and ground.


• Are the resistances less than 5 ohms?
</td><td>Yes
REFER to Section 418-00 to continue module communication diagnosis.

No
REPAIR the circuit in question. TEST the system for normal operation.</td></tr>
</table>

Pinpoint Test B: Incorrect Fuel Gauge Indication

NOTE: The fuel pump module may also be called the fuel delivery module or fuel tank unit. The remote fuel sender may also be called the fuel transfer pump, jet pump module or fuel sender.

Normal Operation

The fuel level status is monitored by the rear electronic module (REM) from the fuel pump module through circuit 8-GA7 (WH/RD) and the remote fuel sender through circuit 8-GA25 (WH/BU). The REM sends the fuel level data to the instrument cluster over the communication network. The REM provides a signal return

(ground) through circuit 9-GA1 (BN/RD), which is spliced to the fuel pump module return circuit 9-GA7 (BN/RD), and the remote fuel sender return circuit 9-GA25 (BN/BU). The normal operating range of the fuel pump module and the remote fuel sender are 15 ± 2 ohms at empty (E) to 160 ± 4 ohms at full (F). The REM provides a reference voltage to the fuel pump module and the remote fuel sender on circuits 8-GA7 (WH/RD) and 8-GA25 (WH/BU) respectively. As the fuel level changes, a float actuates a variable resistor on each sensor (part of the fuel pump module or remote fuel sender) that alters the fuel level signal voltage. The instrument cluster takes the fuel level input from both the fuel pump module and the remote fuel sender, calculates the overall fuel level in the tank and commands the fuel gauge with a corresponding indication.

NOTE: Only instrument cluster DTCs are used for diagnosing the fuel gauge throughout this pinpoint test.

Instrument Cluster (IC) DTCs

DTC Description	Fault Trigger Conditions
• B1201 — Fuel Sender Circuit Failure	A continuous and on-demand DTC that sets in the REM if the REM detects an out of range (open or short to ground) on the fuel pump module input, circuit 8-GA7 (WH/RD), the remote fuel sender input, circuit 8-GA25 (WH/BU), or an open in the signal return, circuit 9-GA7 (BN/RD).
• B1202 — Fuel Sender Circuit Open	A continuous and on-demand DTC that sets in the instrument cluster (IC) if the instrument cluster (IC) detects that the fuel sender is out of range on input circuit 8-GA7 (WH/RD). If the fuel pump module input is open, the instrument cluster sets DTC B1202 and defaults the fuel gauge to the empty position.
• B1204 — Fuel Sender Circuit Short to Ground	A continuous and on-demand DTC that sets in the instrument cluster if the REM detects a short to ground on the fuel pump module input, circuit 8-GA7 (WH/RD). If the fuel pump module input is shorted to ground, the instrument cluster sets DTC B1204 and defaults the fuel gauge to the empty position.
• B2627 — Fuel Sender Circuit Open #2	A continuous and on-demand DTC that sets in the instrument cluster if the REM detects an open in the remote fuel sender input, circuit 8-GA25 (WH/BU). If the remote fuel sender input is open, the instrument cluster sets DTC B2627 and defaults the fuel gauge to the fuel pump module sender value only and the fuel gauge indicates E to 1/2 tank (depending on the fuel level in the fuel pump module side of the tank).
• B2628 — Fuel Sender Circuit Short to Ground #2	A continuous and on-demand DTC that sets in the instrument cluster if the REM detects a short to ground in the remote fuel sender input, circuit 8-GA25 (WH/BU). If the remote fuel sender input is shorted to ground, the instrument cluster sets DTC B2628 and defaults the fuel gauge to the fuel pump module sender value only and the fuel gauge indicates E to 1/2 tank (depending on the fuel level in the fuel pump module side of the tank).
NOTE: Normal operation of the fuel delivery system allows the remote side of the fuel tank (the side opposite of the fuel filler hose) to have	Sets when the instrument cluster (IC) detects a large discrepancy in the amount of fuel (based on input from the fuel senders) between both sides of the fuel tank.

less fuel than the side with the fuel pump module (side with the fuel filler hose). B2879 — Fuel Tank Jet Pump Fault	

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
P0457	Fuel Fill Cap Off	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis of the DTC.
P0460	Fuel Level Sensor A Circuit	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0461	Fuel Level Sensor A Circuit Range/Performance	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0462	Fuel Level Sensor A Circuit Low	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0463	Fuel Level Sensor A Circuit High	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P2065	Fuel Level Sensor B Circuit	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P2066	Fuel Level Sensor B Circuit Range/Performance	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P2067	Fuel Level Sensor B Circuit Low	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P2068	Fuel Level Sensor B Circuit High	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
All other DTCs	—	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Possible Causes

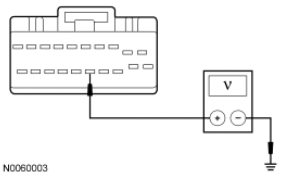
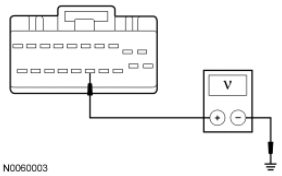
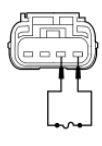
- circuit 8-GA7 (WH/RD) open, short to ground or voltage
- circuit 8-GA25 (WH/BU) open, short to ground or voltage

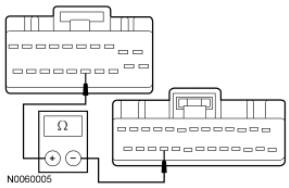
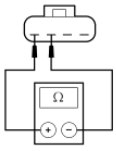
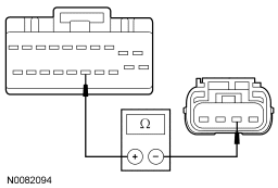
- circuit 9-GA1 (BN/RD) open
- circuit 9-GA7 (BN/RD) open
- circuit 9-GA25 (BN/BU) open
- fuel level sensor
- fuel pump module
- remote fuel sender
- fuel tank transfer tube
- fuel tank
- REM
- instrument cluster

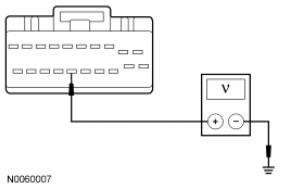
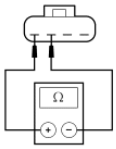
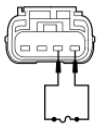
PINPOINT TEST B: INCORRECT FUEL GAUGE INDICATION

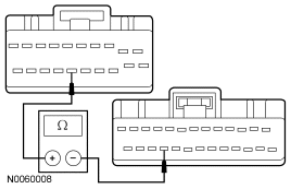
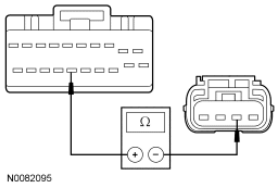
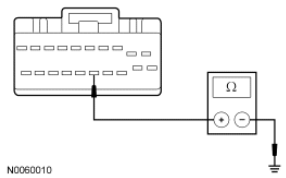
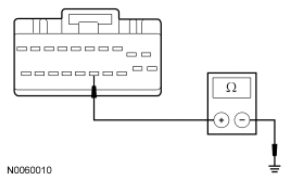
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

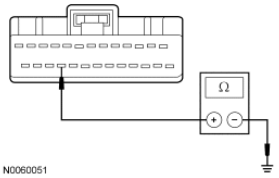
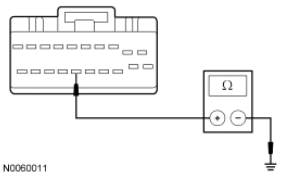
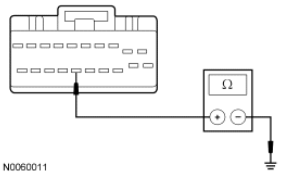
Test Step	Result / Action to Take
B1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
NOTE: Only instrument cluster DTCs are used for diagnosing the fuel gauge throughout this pinpoint test. • Retrieve the recorded instrument cluster DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** For DTC B1202, GO to B3 . For DTC B2627 is retrieved, GO to B8 . For DTC B1204, GO to B12 . For DTC B2628, GO to B15 . For DTC B2879, GO to B18 . For all other instrument cluster DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index in this section. **No** GO to B2 .
B2 CARRY OUT THE INSTRUMENT CLUSTER FUEL GAUGE ACTIVE COMMAND	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster fuel gauge control active command. • Trigger the fuel level active command. Toggle and monitor the fuel gauge on and off. • **Does the fuel gauge needle start at empty (E) and move to full (F) when triggered on then return to empty (E)**	**Yes** GO to B18 . **No** GO to B23 .

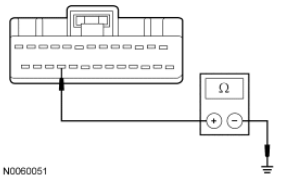
when triggered off?	
B3 CHECK THE FUEL PUMP MODULE CIRCUITRY FOR A SHORT TO VOLTAGE	
• Disconnect: REM C420d. • Ignition ON. • Measure the voltage between the REM C420d-15, circuit 8-GA7 (WH/RD), harness side and ground.  • **Is any voltage present?**	**Yes** GO to B4 . **No** GO to B5 .
B4 CHECK THE FUEL PUMP MODULE FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Fuel Pump Module C433. • Ignition ON. • Measure the voltage between the REM C420d-15, circuit 8-GA7 (WH/RD), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new fuel pump module. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test.
B5 CHECK THE FUEL PUMP MODULE CIRCUITRY FOR AN OPEN	
• Ignition OFF. • Disconnect: Fuel Pump Module C433. • Disconnect: REM C420c. • Connect a fused (5A) jumper wire between the fuel pump module C433-2, circuit 8-GA7 (WH/RD), harness side and the fuel pump module C433-1, circuit 9-GA7 (BN/RD), harness side.  	**Yes** REMOVE the jumper wire. GO to B6 . **No** REMOVE the jumper wire. GO to B7 .

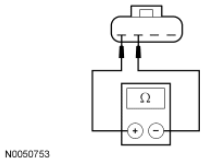
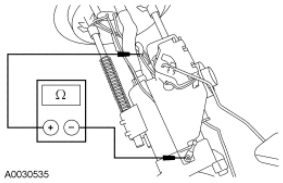
• Measure the resistance between the REM C420d-15, circuit 8-GA7 (WH/RD), harness side and the instrument cluster C420c-23, circuit 9-GA1 (BN/RD), harness side.  N0060005 • **Is the resistance less than 5 ohms?**	
B6 CHECK THE FUEL PUMP MODULE FOR AN OPEN	
NOTE: The fuel sender resistance varies from 15 ± 2 ohms when empty (E) to 160 ± 4 ohms when full (F). • Measure the resistance between the fuel pump module C433 pin 1, component side and the fuel pump module C433 pin 2, component side.  N0050753 • **Is the resistance within specifications?**	**Yes** GO to B22 . **No** GO to B21 .
B7 CHECK CIRCUIT 8-GA7 (WH/RD) FOR AN OPEN	
• Measure the resistance between the REM C420d-15, circuit 8-GA7 (WH/RD), harness side and the fuel pump module C433-2, circuit 8-GA7 (WH/RD), harness side.  N0082094 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit 9-GA1 (BN/RD) or 9-GA7 (BN/RD) for an open. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 8-GA7 (WH/RD). CLEAR the DTCs. REPEAT the self-test.
B8 CHECK CIRCUIT 8-GA25 (WH/BU) FOR A SHORT TO VOLTAGE	
• Disconnect: REM C420d. • Ignition ON. • Measure the voltage between the REM C420d-16, circuit 8-GA25 (WH/BU), harness side and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B9 .

 N0060007 • **Is any voltage present?**	
B9 CHECK THE REMOTE FUEL SENDER FOR AN OPEN	
NOTE: The remote fuel sender resistance varies from 15 ± 2 ohms when empty (E) to 160 ± 4 ohms when full (F). • Ignition OFF. • Disconnect: Remote Fuel Sender C434. • Measure the resistance between the remote fuel sender C434 pin 1, component side and the remote fuel sender C434 pin 2, component side.  N0050753 • **Is the resistance within specifications?**	**Yes** GO to B10 . **No** INSTALL a new remote fuel sender. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test.
B10 CHECK THE FUEL LEVEL SENSOR CIRCUITRY FOR AN OPEN	
• Disconnect: REM C420c. • Connect a fused (5A) jumper wire between the fuel pump module C434-1, circuit 8-GA25 (WH/BU), harness side and the fuel pump module C434-2, circuit 9-GA25 (BN/BU), harness side.  N0050754 • Measure the resistance between the REM C420d-16, circuit 8-GA25 (WH/BU), harness side and the REM C420c-23, circuit 9-GA1 (BN/RD), harness side.	**Yes** REMOVE the jumper wire. GO to B22 . **No** REMOVE the jumper wire. GO to B11 .

 N0060008 • **Is the resistance less than 5 ohms?**	
B11 CHECK CIRCUIT 8-GA25 (WH/BU) FOR AN OPEN	
• Measure the resistance between the REM C420d-16, circuit 8-GA25 (WH/BU), harness side and the fuel sender C434-2, circuit 8-GA25 (WH/BU), harness side.  N0082095 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit 9-GA1 (BN/RD) or 9-GA25 (BN/BU) for an open. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 8-GA25 (WH/BU). CLEAR the DTCs. REPEAT the self-test.
B12 CHECK THE FUEL PUMP MODULE FOR A SHORT TO GROUND	
• Disconnect: REM C420c. • Disconnect: REM C420d. • Measure the resistance between the REM C420d-15, circuit 8-GA7 (WH/RD), harness side and ground.  N0060010 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B22 . **No** GO to B13 .
B13 CHECK CIRCUIT 8-GA7 (WH/RD) FOR A SHORT TO GROUND	
• Disconnect: Fuel Pump Module C433. • Measure the resistance between the REM C420d-15, circuit 8-GA7 (WH/RD), harness side and ground.  N0060010 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B14 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B14 CHECK CIRCUITS 9-GA1 (BN/RD) AND 9-GA7 (BN/RD) FOR A SHORT TO GROUND	
• Measure the resistance between the REM C420c-23, circuit 9-GA1 (BN/RD), harness side and ground.  N0060051 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new fuel pump module. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
B15 CHECK THE REMOTE FUEL SENDER FOR A SHORT TO GROUND	
• Disconnect: REM C420c. • Disconnect: REM C420d. • Measure the resistance between the REM C420d-16, circuit 8-GA25 (WH/BU), harness side and ground.  N0060011 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B22 . **No** GO to B16 .
B16 CHECK CIRCUIT 8-GA25 (WH/BU) FOR A SHORT TO GROUND	
• Disconnect: Remote Fuel Sender C434. • Measure the resistance between the REM C420d-16, circuit 8-GA25 (WH/BU), harness side and ground.  N0060011 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B17 . **No** REPAIR the circuit 8-GA25 (WH/BU) for a short to ground. CLEAR the DTCs. REPEAT the self-test.
B17 CHECK CIRCUITS 9-GA1 (BN/RD) AND 9-GA25 (BN/BU) FOR A SHORT TO GROUND	

• Measure the resistance between the REM C420c-23, circuit 9-GA1 (BN/RD), harness side and ground.  N0060051 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new remote fuel sender. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
B18 INSPECT THE FUEL TANK	
• Visually inspect the fuel tank for any damage or deformation. • **Is the fuel tank OK?**	**Yes** GO to B19 . **No** VERIFY that the fuel pump module and remote fuel sender is not damaged. INSTALL a new fuel tank. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self test.
B19 INSPECT THE FUEL TANK TRANSFER TUBE CONNECTIONS	
• Remove the fuel pump module and the remote fuel sender. Refer to Section 310-01 fuel pump module and fuel transfer pump. • Inspect the fuel tank transfer tube, connections, the fuel pump module and the remote fuel sender for any leaking, damage or deformation that may prevent the fuel transfer from the remote fuel sender side of the tank to the fuel pump module side of the tank. • **Are the fuel tank transfer tube, connections, the fuel pump module and the remote fuel sender OK?**	**Yes** GO to B20 . **No** INSTALL a new fuel tank transfer tube, fuel pump module or remote fuel sender as necessary. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self test.
B20 CHECK THE FUEL PUMP MODULE AND THE REMOTE FUEL SENDER FOR CORRECT OPERATION	
NOTE: The resistance varies from 15 ± 2 ohms when empty (E) to 160 ± 4 ohms when full (F). • Measure the resistance between the fuel pump module C433 pin 1, component side and the fuel pump module C433 pin 2, component side; and between the remote fuel sender C434 pin 1, component side and remote fuel sender C434 pin 2, component side while slowly moving the float arm from the bottom to the top of travel.	**Yes** INSTALL a new fuel tank transfer tube. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self test. **No** For the fuel pump module, GO to B21 . For the remote fuel sender, INSTALL a new remote fuel sender. REFER to Section 310-01 , fuel transfer pump. CLEAR the DTCs. REPEAT the self-test.

 N0050753 • **Does the resistance start at approximately 15 ohms with the float at the bottom of travel and slowly increase to approximately 160 ohms at the top of travel?**	
B21 CHECK THE FUEL LEVEL SENSOR	
• **NOTE:** The fuel level sensor resistance will measure between 15 ohms ± 2 ohms at the lower stop position and 160 ohms ± 4 ohms at the upper stop position. • Remove the fuel pump module. Refer to Section 310-01 . • Ignition OFF. • **NOTE:** Disconnect the fuel level sensor input wire from the fuel level sensor for this measurement. • Measure the resistance between the fuel level sensor input wire and the fuel level sensor ground while slowly moving the float arm between the lower stop and the upper stop position.  A0030535 • **Does the resistance slowly increase from approximately 15 ohms to 160 ohms?**	**Yes** INSTALL a new fuel pump module. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new fuel level sensor. CLEAR the DTCs. REPEAT the self-test.
B22 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. If incorrect fuel gauge indication is still present, INSTALL the original REM. GO to B12 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

B23 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: • corrosion	**Yes** INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for

• pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: Incorrect Temperature Gauge Indication

Normal Operation

The cylinder head temperature (CHT) sensor monitors the coolant temperature at the cylinder head and is hardwired directly to the powertrain control module (PCM). The status of the engine coolant temperature is sent from the PCM to the instrument cluster over the communication network. The instrument cluster logs diagnostic trouble code (DTC) U1073 if the instrument cluster fails to receive the engine temperature status from the PCM.

Possible Causes
- PCM
- instrument cluster

PINPOINT TEST C: INCORRECT TEMPERATURE GAUGE INDICATION

Test Step	Result / Action to Take
C1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER AND PCM SELF-TESTS	
• Check for recorded instrument cluster and PCM DTCs from the continuous and on-demand self-tests. • **Are any instrument cluster or PCM DTCs recorded?**	**Yes** If any PCM DTCs are retrieved, or if instrument cluster DTC U1073 is retrieved, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis. All other DTCs, refer to the Instrument Cluster Diagnostic Trouble Code (DTC) Index. **No** GO to C2 .
C2 CARRY OUT THE INSTRUMENT CLUSTER ENGINE COOLANT TEMPERATURE GAUGE ACTIVE COMMAND	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command.	**Yes** GO to C3 . **No** GO to C4 .

• Select the instrument cluster engine coolant control active command. • Trigger the engine coolant active command. Toggle and monitor the engine coolant temperature gauge while adjusting the engine coolant active command to read 50% and 100%. • **Does the temperature gauge needle start at cold, move to half at 50%, and full hot at 100%?**	
C3 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all PCM the connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

C4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: The Low Fuel Warning Indicator Is Never/Always On

Normal Operation

Typically, the low fuel indicator turns on when the fuel level reaches a predetermined level of approximately 1/8 tank. The low fuel level warning indicator and fuel gauge are controlled by the instrument cluster based upon the fuel level data provided by the rear electronic module (REM). When the instrument cluster receives data from the REM that indicates the fuel level has reached the preset low fuel level, the fuel gauge indicates low fuel and the instrument cluster turns on the low fuel warning indicator. A correctly functioning fuel gauge indicates that the fuel pump modules, the circuitry to the REM, and the REM are operating correctly.

Possible Causes

- instrument cluster

PINPOINT TEST D: THE LOW FUEL WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
D1 CHECK THE FUEL GAUGE OPERATION	
• Check the operation of the fuel gauge. • **Does the fuel gauge operate correctly?**	**Yes** GO to D2 . **No** GO to Pinpoint Test B to continue diagnosis of the fuel gauge.
D2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Speedometer Is Inoperative

Normal Operation

Vehicle speed information is sent to the instrument cluster by the powertrain control module (PCM) over the communication network. The PCM calculates vehicle speed from the transmission output shaft speed (OSS) sensor input. Factors that could affect the speedometer indication are tire size.

Possible Causes

- PCM
- instrument cluster

PINPOINT TEST E: THE SPEEDOMETER IS INOPERATIVE

Test Step	Result / Action to Take
E1 CARRY OUT THE INSTRUMENT CLUSTER SPEEDOMETER ACTIVE COMMAND	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster speedometer command active command.	**Yes** GO to E2 . **No** GO to E5 .

• Trigger the speedometer and scroll in increments of 10%. Monitor the speedometer gauge. The speedometer should be increasing in increments of 26 km/h (16 mph) for every 10%. • **Does the speedometer increase within specification?**	
E2 RETRIEVE THE RECORDED DTCs FROM THE POWERTRAIN CONTROL MODULE (PCM) KEY ON ENGINE OFF (KOEO) SELF-TEST	
• Check for recorded PCM DTCs from the KOEO self-test. • **Are any DTCs recorded?**	**Yes** DIAGNOSE all PCM DTCs first. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to E3 .
E3 RETRIEVE THE RECORDED INSTRUMENT CLUSTER DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded instrument cluster DTCs from the continuous and on-demand self-test. • **Are any DTCs recorded?**	**Yes** REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index in this section. **No** GO to E4 .
E4 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

E5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect the instrument cluster connector.
• Check for:
  • corrosion
  • pushed-out pins
• Connect the instrument cluster connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

Pinpoint Test F: The Odometer Is Inoperative

Normal Operation

Vehicle odometer information is sent to the instrument cluster from the powertrain control module (PCM) over the communication network. Diagnostic trouble code (DTC) U1123 is logged if the instrument cluster fails to receive the odometer rolling count status from the PCM. The instrument cluster logs DTC B2143 if the instrument cluster detects a nonvolatile memory (NVM) failure.

Possible Causes

- instrument cluster

PINPOINT TEST F: THE ODOMETER IS INOPERATIVE

Test Step	Result / Action to Take
F1 CHECK THE SPEEDOMETER OPERATION	
• Operate the vehicle to verify that the speedometer operates correctly. • **Does the speedometer operate correctly?**	**Yes** GO to F2 . **No** GO to Pinpoint Test E to continue diagnosis of the speedometer.
F2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: The Tachometer Is Inoperative

Normal Operation

The engine speed is monitored by the powertrain control module (PCM) through the crankshaft position (CKP) sensor. The CKP is hardwired directly to the PCM. The status of the CKP is sent from the PCM to the instrument cluster over the communication network.

Possible Causes

- PCM
- instrument cluster

PINPOINT TEST G: THE TACHOMETER IS INOPERATIVE

Test Step	Result / Action to Take
G1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Retrieve the recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the DTC. **No** GO to G2 .
G2 CARRY OUT THE INSTRUMENT CLUSTER TACHOMETER ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster tachometer control active command. Trigger the tachometer active command. Adjust the scroll knob until the tachometer reads 50% and 100%. Observe the tachometer gauge reading. • **Does the tachometer gauge needle start at 0 rpm, move to approximately 3,500 rpm at 50%, and 7,000 rpm at 100%?**	**Yes** GO to G4 . **No** GO to G3 .
G3 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

G4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused

• **Is the concern still present?**	by a loose or corroded connector.

Pinpoint Test H: The Door Ajar Indicator Is Inoperative (Chime Is Operative)/Does Not Operate Correctly

Normal Operation

The normally open front door ajar switches are hardwired to the front electronic module (FEM) and the normally open rear door ajar switches are hardwired to the rear electronic module (REM). When a door is open, the door ajar switch provides a ground signal to the FEM or REM. When the door is closed, the door ajar switch opens, removing the ground signal to the FEM or REM. The FEM and REM use the multiple inputs from the door ajar switches to determine whether the doors are in the opened or closed position and provide a signal to the instrument cluster over the communication network. A door ajar chime that is operating correctly indicates that the FEM or the REM is monitoring the correct operation of the door ajar switches.

Possible Causes
- instrument cluster

PINPOINT TEST H: THE DOOR AJAR INDICATOR IS INOPERATIVE (CHIME IS OPERATIVE)/DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
H1 CHECK THE INTERIOR DOME LAMP OPERATION	
• Ignition ON. • Open and close each door and monitor the interior dome lamp. • **Does the interior dome lamp operate correctly?**	**Yes** GO to H2 . **No** REFER to Section 417-02 to continue diagnosis of the interior lamps.
H2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the door ajar warning indicator. • **Does the door ajar warning indicator turn on when triggered on, and turn off when triggered off?**	**Yes** GO to H3 . **No** GO to H4 .
H3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND FEM AND REM SELF-TESTS	
• Check for recorded FEM and REM DTCs from the continuous and on-demand self-tests.	**Yes** REFER to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC)

• **Are any FEM or REM DTCs recorded?**	Index or the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index to continue diagnosis of the DTC. **No** GO to H4 .
H4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Safety Belt Warning Indicator Is Never/Always On

Normal Operation

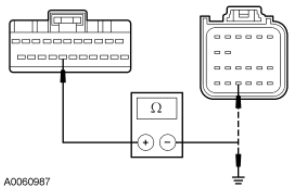
The safety belt switch is hardwired to the restraints control module (RCM). The instrument cluster receives the safety belt switch status from the RCM through circuit 8-GE52 (WH/BK). The RCM monitors the safety belt switch and signals the instrument cluster to turn on the safety belt warning indicator when the safety belt is unfastened.

Possible Causes
- circuit 8-GE52 (WH/BK) open or short to ground
- safety belt switch
- instrument cluster

PINPOINT TEST I: THE SAFETY BELT WARNING INDICATOR IS NEVER/ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
I1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND RCM SELF-TESTS	
• Check for recorded RCM DTCs from the continuous and on-demand self-tests. • **Are any RCM DTCs recorded?**	**Yes** REFER to Section 501-20B to continue the diagnosis of the restraints control system. **No** GO to I2 .

I2 MONITOR THE INSTRUMENT CLUSTER SAFETY BELT PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Select and monitor the instrument cluster safety belt PID while fastening and unfastening the safety belt. • **Does the PID agree with the safety belt position?**	**Yes** GO to I4 . **No** GO to I3 .
I3 CHECK CIRCUIT 8-GE52 (WH/BK) FOR AN OPEN AND A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Instrument Cluster C220a. • Disconnect: RCM C310a. • Deactivate the air bag system. Refer to Section 501-20B . • Measure the resistance between the instrument cluster C220a-18, circuit 8-GE52 (WH/BK), harness side and the RCM C310a-22, circuit 8-GE52 (WH/BK), harness side; and between the instrument cluster C220a-18, circuit 8-GE52 (WH/BK), harness side and ground.  A0060987 • **Is the resistance less than 5 ohms between the instrument cluster and the RCM, and greater than 10,000 ohms between the instrument cluster and ground?**	**Yes** REPAIR the safety belt switch. CONNECT the RCM. REFER to Section 501-20B . ACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation. **No** REPAIR the circuit. CONNECT the RCM. ACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation.
I4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Low Oil Pressure Warning Indicator Is Never/Always On

Normal Operation

The engine oil pressure switch is a normally closed switch that is hardwired to the front electronic module (FEM) through circuit 8-GC21 (WH/GN). When the oil pressure is within normal ranges, the engine oil pressure switch opens, removing the ground signal to the FEM. The FEM then sends a signal to the instrument cluster through the communication network to turn off the oil pressure warning indicator. When the oil pressure is low, the engine oil pressure switch closes, grounding circuit 8-GC21 (WH/GN). The FEM then sends a low oil pressure signal to the instrument cluster through the communication network to turn on the oil pressure warning indicator.

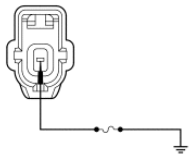
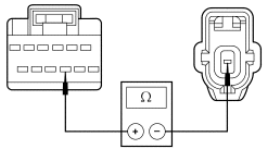
Possible Causes

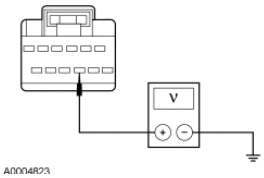
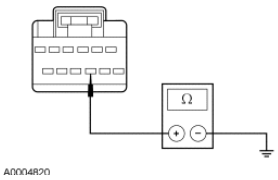
- circuit 8-GC21 (WH/GN) open, short to ground, or short to voltage
- low engine oil pressure
- engine oil pressure switch
- FEM
- instrument cluster

PINPOINT TEST J: THE LOW OIL PRESSURE WARNING INDICATOR IS NEVER/ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
J1 CHECK THE INSTRUMENT CLUSTER LOW OIL PRESSURE WARNING INDICATOR ILLUMINATION	
NOTE: Verify that the oil level is at or near the FULL level. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the low oil pressure warning indicator. • **Does the low oil pressure warning indicator turn on when triggered on, and turn off when triggered off?**	**Yes** GO to J2 . **No** GO to J8 .
J2 MONITOR THE FEM LOW OIL PRESSURE PID	
• Ignition OFF. • Disconnect: Engine Oil Pressure Switch C103. • Ignition ON. • Enter the following diagnostic mode on the scan tool: FEM Engine Oil Pressure PID. • Monitor the FEM engine oil pressure PID. • Connect a fused (10A) jumper wire between the engine oil pressure switch C103-1, circuit 8-GC21 (WH/GN), harness side and ground.	**Yes** GO to J3 . **No** If the oil pressure indicator is inoperative, GO to J4 . If the oil pressure indicator is always on, GO to J6 .

 A0004R21 • **Does the PID indicate normal engine oil pressure with the jumper wire removed, and low engine oil pressure with the jumper wire connected?**	
J3 CARRY OUT THE ENGINE OIL PRESSURE TEST	
• Carry out the engine oil pressure test. Refer to Section 303-00 . • **Is the engine oil pressure within specification?**	**Yes** INSTALL a new engine oil pressure switch. CLEAR the DTCs. REPEAT the self-test. **No** REFER to Section 303-00 to continue diagnosis of the engine oil pressure.
J4 CHECK CIRCUIT 8-GC21 (WH/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: FEM 201c. • Measure the resistance between the FEM C201c-9, circuit 8-GC21 (WH/GN), harness side and the engine oil pressure switch C103-1, circuit 8-GC21 (WH/GN), harness side.  A0004R22 • **Is the resistance less than 5 ohms?**	**Yes** GO to J5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
J5 CHECK CIRCUIT 8-GC21 (WH/GN) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the FEM C201c-9, circuit 8-GC21 (WH/GN), harness side and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to J7 .

 • **Is any voltage present?**	
J6 CHECK CIRCUIT 8-GC21 (WH/GN) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: FEM C201c. • Measure the resistance between the FEM C201c-9, circuit 8-GC21 (WH/GN), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to J7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
J7 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

J8 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The Charging System Warning Indicator Is Never/Always On

Normal Operation

The charging system is hardwired to the powertrain control module (PCM). The PCM monitors the battery state of charge and provides generator voltage regulator controls, which effectively increase or decrease the generator output to maintain battery charge and to meet electrical demands on the system. The charging system status is then sent from the PCM to the instrument cluster over the communication network. When the generator output is low, the PCM sends a command to the instrument cluster to turn on the charging system warning indicator. Instrument cluster DTC B1317 is set if the battery voltage is greater than 17.82 volts ± 1.9 volts DC. Instrument cluster DTC B1318 is set if the battery voltage is less than 9.0 volts ± 1.5 volts DC. For additional information on the charging system, refer to Section 414-00 .

Possible Causes

- charging system
- PCM
- instrument cluster

PINPOINT TEST K: THE CHARGING SYSTEM WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
K1 CHECK THE CHARGING SYSTEM FOR CORRECT OPERATION	
• Check the charging system operation. Refer to Section 414-00 . • **Is the charging system operating correctly?**	**Yes** GO to K2 . **No** REFER to Section 414-00 to continue diagnosis of the charging system.
K2 CHECK THE CHARGING SYSTEM WARNING INDICATOR	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the charging system warning indicator. • **Does the charge system warning indicator turn on when triggered on, and turn off when triggered off?**	**Yes** GO to K3 . **No** GO to K4 .
K3 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

K4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Brake Warning Indicator Is Never On

Normal Operation

The instrument cluster uses the brake fluid level, engagement of the parking brake, and the base brake system operation to provide inputs for the BRAKE warning indicator. The brake fluid level sensor is hardwired to the front electronic module (FEM) through circuit 8-GC7 (WH/RD) and is grounded through circuit 31-GC7 (BK/BU). When the brake fluid level is low, the FEM sends a command to the instrument cluster over the communication network to turn on the BRAKE warning indicator. The parking brake system is monitored and controlled by the parking brake module. When the parking brake is applied, the parking brake module sends a command to the instrument cluster over the communication network to turn on the BRAKE warning indicator. The ABS module monitors the brake pressures within the base brake system and provides a message to the instrument cluster over the communication network when a concern exists.

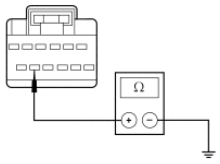
Possible Causes

- circuit 8-GC7 (WH/RD) open or short to ground
- electronic parking brake system
- brake fluid level sensor
- FEM
- parking brake module
- instrument cluster

PINPOINT TEST L: THE BRAKE WARNING INDICATOR IS NEVER ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
L1 CHECK THE INSTRUMENT CLUSTER BRAKE WARNING INDICATOR ILLUMINATION	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on. Observe the brake warning indicator.	**Yes** GO to L2 . **No** GO to L8 .

• **Does the brake warning indicator turn on when triggered on?**	
L2 CHECK THE BRAKE FLUID LEVEL SWITCH OPERATION	
• Disconnect: Brake Fluid Level Sensor C1395. • **Does the brake warning indicator illuminate?**	**Yes** GO to L5 . **No** GO to L3 .
L3 CHECK THE BRAKE FLUID LEVEL FEM PID	
• Enter the following diagnostic mode on the scan tool: FEM Brake Fluid Level PID. • Select and monitor the FEM brake fluid level PID. • Connect a fused (10A) jumper wire between the brake fluid warning sensor C1395-1, circuit 8-GC7 (WH/RD), harness side and the brake fluid warning sensor C1395-2, circuit 31-GC7 (BK/BU), harness side. A0060988 • **Does the PID read off when the jumper wire is not connected, and on when the jumper wire is connected?**	**Yes** GO to L8 . **No** GO to L4 .
L4 CHECK CIRCUIT 8-GC7 (WH/RD) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: FEM C201c. • Measure the resistance between the FEM C201c-11, circuit 8-GC7 (WH/RD), harness side and ground.  A0004840 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to L7 . **No** REPAIR the circuit. TEST the system for normal operation.
L5 CHECK THE ELECTRONIC PARKING BRAKE SYSTEM OPERATION	
• Operate the electronic parking brake system and verify the system operates correctly. • **Does the electronic parking brake system operate correctly?**	**Yes** GO to L6 . **No** REFER to Section 206-05 to continue diagnosis of the electronic

	parking brake system.
L6 CHECK THE PARKING BRAKE MODULE PARKING BRAKE SWITCH INPUT	
• Enter the following diagnostic mode on the scan tool: Parking Brake Module PID. • Select and monitor the electronic parking brake module apply switch active, and release switch active, PIDs while switching the electronic parking brake on and off. • **Do the apply switch active and release switch active PIDs agree with the switch position?**	**Yes** GO to L8 . **No** GO to L9 .
L7 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

L8 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

L9 CHECK FOR CORRECT PARKING BRAKE MODULE OPERATION	

• Disconnect all the parking brake module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the parking brake module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking brake module. REFER to Section 206-05 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: The High Beam Indicator Is Never/Always On

Normal Operation

The instrument cluster uses both headlamp switch position and multifunction switch position inputs to control the high beam indicator. The headlamp switch signal is transmitted to the instrument cluster from the headlamp switch through signal circuit 8-LE21 (WH/GN) and return circuit 9-LE29 (BN/GN). Once the instrument cluster senses the headlamp ON signal, the cluster monitors the resistance through the multifunction switch to determine whether the switch is in the high beam or low beam position. The multifunction switch is hardwired to the instrument cluster.

Possible Causes

- instrument cluster

PINPOINT TEST M: THE HIGH BEAM INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
M1 CHECK THE HIGH BEAM HEADLAMP OPERATION	
• Ignition ON. • Place headlamp switch in the ON position. • Place the multifunction switch in the high beam and then in the low beam position. • **Do the high beam headlamps operate correctly?**	**Yes** GO to M2 . **No** REFER to Section 417-01 to continue diagnosis of the high beam headlamps.
M2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test N: The Low Washer Fluid Warning Indicator Is Never/Always On

Normal Operation

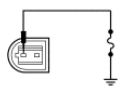
The low washer fluid switch is hardwired to the front electronic module (FEM) through circuit 8-GC8 (WH/BU) and grounded through circuit 31-GC8 (BK/OG). The FEM monitors the washer fluid level and sends the low washer fluid data to the instrument cluster over the communication network.

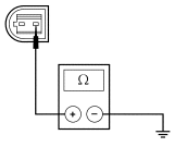
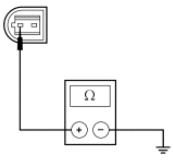
Possible Causes

- circuit 8-GC8 (WH/BU) open or short to ground
- circuit 31-GC8 (BK/OG) open
- low washer fluid switch
- FEM
- instrument cluster

PINPOINT TEST N: THE LOW WASHER FLUID WARNING INDICATOR IS NEVER/ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
N1 CHECK THE LOW WASHER FLUID WARNING INDICATOR	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. • **Does the low washer fluid warning indicator turn on when triggered on, and turn off when triggered off?**	**Yes** GO to N2 . **No** GO to N6 .
N2 MONITOR THE FEM WASHER FLUID LEVEL PID	
• Ignition OFF. • Disconnect: Washer Fluid Level Switch C138. • Ignition ON. • Enter the following diagnostic mode on the scan tool: FEM Washer Fluid Level PID. • Monitor the FEM washer fluid level PID. • Ignition OFF. • **NOTE:** If the fuse fails, repair the circuit for a short to ground. • Connect a fused (10A) jumper wire between washer fluid level switch C138-2, circuit 8-GC8 (WH/BU), harness side and ground.  A0004841 • Ignition ON. • Monitor the FEM washer fluid level PID. • **Does the PID indicate the fluid level is OK with the jumper wire removed, and low fluid level**	**Yes** REMOVE the jumper wire. GO to N3 . **No** REMOVE the jumper wire. GO to N4 .

with the jumper wire connected?	
N3 CHECK CIRCUIT 31-GC8 (BK/OG) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the washer fluid level switch C138-1, circuit 31-GC8 (BK/OG), harness side and ground.  A0004810 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new windshield washer reservoir. REFER to Section 501-16 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
N4 CHECK CIRCUIT 8-GC8 (WH/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: FEM C201b. • Measure the resistance between the washer fluid level switch C138-2, circuit 8-GC8 (WH/BU), harness side and ground.  A0004806 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to N5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
N5 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

N6 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

• Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test O: The Anti-Lock Brake System (ABS) Warning Indicator Is Never On

Normal Operation

The status of the ABS is sent to the instrument cluster over the communication network. The instrument cluster monitors the input and illuminates the ABS warning indicator when a concern is present.

Possible Causes
- ABS module
- instrument cluster

PINPOINT TEST O: THE ANTI-LOCK BRAKE SYSTEM (ABS) WARNING INDICATOR IS NEVER ON

Test Step	Result / Action to Take
O1 CARRY OUT THE INSTRUMENT CLUSTER ABS WARNING INDICATOR ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on. Observe the ABS warning indicator. • **Does the ABS warning indicator illuminate?**	**Yes** GO to O2 . **No** GO to O3 .
O2 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect the ABS module connector.
• Check for:
  • corrosion
  • pushed-out pins
• Connect the ABS module connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

O3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: • corrosion	**Yes** INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

• pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: The Traction Control And Advance Traction Control Indicators Are Never/Always On

Normal Operation

The traction control status is monitored by the anti-lock brake system (ABS) module. When the traction control is in active mode, a traction active status message is sent to the instrument cluster from the ABS module over the communication network.

Possible Causes
- ABS module
- instrument cluster

PINPOINT TEST P: THE TRACTION CONTROL AND ADVANCE TRACTION CONTROL INDICATORS ARE NEVER/ALWAYS ON

Test Step	Result / Action to Take
P1 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the traction control and advanced traction control indicators. • **Do both the traction control and advanced traction control indicators turn on when triggered on, and turn off when triggered off?**	**Yes** GO to P2 . **No** GO to P3 .
P2 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect the ABS module connector.
• Check for:
  • corrosion
  • pushed-out pins
• Connect the ABS module connector and make sure it seats correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

P3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Q: The Powertrain Malfunction (Wrench) Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the powertrain malfunction (wrench) status from the powertrain control module (PCM) over the communication network. When a system concern is detected, the PCM sends the instrument cluster a command signal to illuminate the powertrain malfunction (wrench) indicator.

Possible Causes
- PCM
- instrument cluster

PINPOINT TEST Q: THE POWERTRAIN MALFUNCTION (WRENCH) INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
Q1 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the powertrain malfunction (wrench) indicator. • **Does the powertrain malfunction (wrench) indicator illuminate when triggered on, and turn off when triggered off?**	**Yes** GO to Q3 . **No** GO to Q2 .
Q2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

• Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
Q3 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test R: The Malfunction Indicator Lamp (MIL) Is Never/Always On

Normal Operation

The powertrain control module (PCM) monitors and controls the powertrain functions. When the PCM detects a concern, the PCM provides a signal over the communication network to the instrument cluster. The instrument cluster then turns on the MIL.

Possible Causes
- PCM
- instrument cluster

PINPOINT TEST R: THE MALFUNCTION INDICATOR LAMP (MIL) IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
R1 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the MIL. • **Does the MIL illuminate when triggered on, and turn off when triggered off?**	**Yes** GO to R3 . **No** GO to R2 .
R2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: • corrosion	**Yes** INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

• pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
R3 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: • corrosion • pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test S: The Turn/Hazard Indicator Is Never/Always On

Normal Operation

The multifunction switch is hardwired to the instrument cluster. Differing resistance ranges are used internally within the multifunction switch to allow the instrument cluster to determine whether the multifunction switch is in the RH or LH turn position. The instrument cluster monitors the input from the multifunction switch and turns on either the RH or LH turn/hazard indicators depending on the switch position. The multifunction switch position status is also sent from the instrument cluster to the front electronic module (FEM) and the rear electronic module (REM) to turn on the exterior lighting.

Possible Causes
- instrument cluster

PINPOINT TEST S: THE TURN/HAZARD INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
S1 CHECK THE TURN SIGNAL AND HAZARD LAMPS OPERATION	
• Ignition ON. • Operate the turn signal on the left and right sides. • Operate the hazard lamps. • **Do the turn signals and hazard lamps operate correctly?**	**Yes** GO to S2 . **No** REFER to Section 417-01 to continue diagnosis of the turn/hazard lamps.
S2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors.	**Yes** INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal

• Check for: • corrosion • pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test T: The Steering Wheel Column Lock Warning Indicator Is Never/Always On (If Equipped)

Normal Operation

The instrument cluster monitors the key-in-ignition, the ignition switch status, and the steering wheel column lock status. The steering column lock status is sent to the instrument cluster from the input of the steering column lock module over the communication network. The instrument cluster turns on the steering wheel column lock indicator when the ignition switch is in the RUN position and the steering column is locked.

Possible Causes
- steering wheel column lock module
- instrument cluster

PINPOINT TEST T: THE STEERING WHEEL COLUMN LOCK WARNING INDICATOR IS NEVER/ALWAYS ON (IF EQUIPPED)

Test Step	Result / Action to Take
T1 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the steering wheel column lock indicator. • **Does the steering wheel column lock indicator turn on when triggered on, and turn off when triggered off?**	**Yes** REFER to Section 211-04 to continue diagnosis of the steering wheel column lock. **No** GO to T2 .
T2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: • corrosion • pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present.	**Yes** INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at

• **Is the concern still present?**	this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test U: The Speed Control Indicator Is Never/Always On

Normal Operation

The instrument cluster receives the speed control status from the powertrain control module (PCM) over the communication network. When the speed control is engaged, the PCM provides the instrument cluster with the speed control engaged status message and the instrument cluster illuminates the speed control indicator.

Possible Causes
- PCM
- instrument cluster

PINPOINT TEST U: THE SPEED CONTROL INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
U1 VERIFY THE SPEED CONTROL AND SPEEDOMETER OPERATE CORRECTLY	
• Verify the speed control and the speedometer operate correctly. • **Do the speed control and speedometer operate correctly?**	**Yes** GO to U2 . **No** If the speed control does not operate correctly, REFER to Section 310-03 . If the speedometer does not operate correctly, GO to Pinpoint Test E to continue diagnosis of the speedometer.
U2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the speed control indicator. • **Does the speed control indicator illuminate when triggered on, and turn off when triggered off?**	**Yes** GO to U3 . **No** GO to U4 .
U3 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.

• Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
U4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test V: The Engine Over-Temperature Warning Indicator Is Never/Always On

Normal Operation

The engine temperature status is transmitted to the powertrain control module (PCM) from the cylinder head temperature sensor through circuit 8-RJ33 (WH/VT). The PCM transmits an over-temperature status to the instrument cluster over the communication network. When the engine temperature, as measured at the cylinder head, reaches 121° C (250° F), the PCM enters the first stage of the fail-safe mode and sends a command message to the instrument cluster to turn on the engine over-temperature warning indicator. The instrument cluster logs diagnostic trouble code (DTC) U1073 if the instrument cluster fails to receive the engine temperature status from the PCM.

Possible Causes

- PCM
- instrument cluster

PINPOINT TEST V: THE ENGINE OVER-TEMPERATURE WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
V1 CHECK THE OPERATION OF THE TEMPERATURE GAUGE	
• Start and run the engine until the normal engine operating temperature is reached. • Ignition OFF. • **Does the temperature gauge operate correctly?**	**Yes** GO to V2 . **No** GO to Pinpoint Test C to continue diagnosis of the temperature gauge.
V2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON.	**Yes** GO to V4 .

• Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the engine over-temperature indicator. • **Does the engine over-temperature indicator illuminate when triggered on, and turn off when triggered off?**	**No** GO to V3 .
V3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

V4 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test W: The Air Bag Warning Indicator Is Never On

Normal Operation

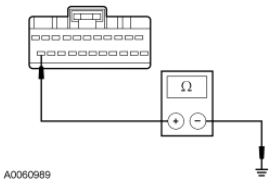
The restraints control module (RCM) is hardwired to the instrument cluster through circuit 31S-JA14 (BK/GN). When the RCM detects a system concern, a diagnostic trouble code (DTC) is set and the RCM removes the ground to the instrument cluster to turn on the AIR BAG warning indicator. RCM DTC B1869 is set if circuit 31S-JA14 (BK/GN) is open or shorted to ground. RCM DTC B1870 is set if circuit 31S-JA14 (BK/GN) is shorted to voltage.

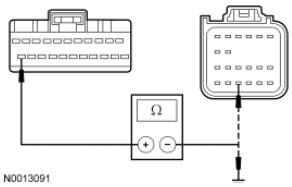
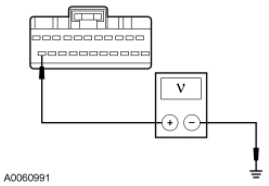
Possible Causes

- circuit 31S-JA14 (BK/GN) open, short to ground, or short to voltage
- RCM
- instrument cluster

PINPOINT TEST W: THE AIR BAG WARNING INDICATOR IS NEVER ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
W1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND RCM SELF-TESTS	
• Retrieve the recorded RCM DTCs from the continuous and on-demand self-tests. • **Are any RCM DTCs recorded?**	**Yes** If RCM DTC B1869 or B1870 are retrieved, GO to W3 . For all other RCM DTCs, REFER to Section 501-20B . **No** GO to W2 .
W2 CHECK THE RCM FOR CORRECT OPERATION	
NOTE: The resistance during this test should be greater than 10,000 ohms for approximately 4 seconds then switch to less than 5 ohms during bulb prove out. • Disconnect: Instrument Cluster C220a. • Ignition ON. • Measure the resistance between the instrument cluster C220a-22, circuit 31S-JA14 (BK/GN), harness side and ground.  • **Is the resistance less than 5 ohms during prove out, then change to greater than 10,000 ohms?**	**Yes** GO to W6 . **No** GO to W3 .
W3 CHECK CIRCUIT 31S-JA14 (BK/GN) FOR AN OPEN OR A SHORT TO GROUND	
• Ignition OFF. • Deactivate the air bag system. Refer to Section 501-20B . • Disconnect: RCM C310a. • Measure the resistance between the instrument cluster C220a-22, circuit 31S-JA14 (BK/GN), harness side and the RCM C310a-19, circuit 31S-JA14 (BK/GN), harness side; and between the instrument cluster C220a-22, circuit 31S-JA14	**Yes** GO to W4 . **No** REPAIR the circuit. CONNECT the RCM. ACTIVATE the air bag system. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

(BK/GN), harness side and ground.  • **Is the resistance less than 5 ohms between the instrument cluster and the RCM, and greater than 10,000 ohms between the instrument cluster and ground?**	
W4 CHECK CIRCUIT 31S-JA14 (BK/GN) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the instrument cluster C220a-22, circuit 31S-JA14 (BK/GN), harness side and ground.  • **Is any voltage indicated?**	**Yes** REPAIR the circuit. CONNECT the RCM. ACTIVATE the air bag system. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** GO to W5 .
W5 CHECK FOR CORRECT RCM OPERATION	

• Disconnect all the RCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the RCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new RCM. REFER to Section 501-20B . ACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ACTIVATE the air bag system. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

W6 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No

• Operate the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test X: The Check Fuel Cap Indicator Is Never/Always On

Normal Operation

The powertrain control module (PCM) monitors the fuel tank evaporative system for significant leaks that occur following refueling of the vehicle. If a fuel tank pressure change greater than a -23.7 kPa (7 in Hg) of vacuum occurs within 30-seconds after refueling, or there is an excessive purge (fuel vapor) flow greater than 454 g (0.06 lb) per minute, the PCM sets diagnostic trouble code (DTC) P0457 and sends a message to the instrument cluster over the communication network to illuminate the check fuel cap indicator.

Possible Causes
- PCM
- instrument cluster

PINPOINT TEST X: THE CHECK FUEL CAP INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
X1 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
NOTE: Once the check fuel cap indicator turns on, it does not turn off unless the fuel cap is correctly secured and the vehicle is driven for several minutes. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger the all lamps active command on and off. Observe the check fuel cap indicator. • **Does the check fuel cap indicator illuminate when triggered on, and turn off when triggered off?**	**Yes** GO to X2 . **No** GO to X3 .
X2 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by

present. • **Is the concern still present?**	a loose or corroded connector.
X3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they are seated correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Y: The Integrated Circuit Display Is Inoperative

Normal Operation

The digital transmission range (TR) sensor is hardwired directly to the powertrain control module (PCM), which provides the instrument cluster with the transmission range data over the communication network. The instrument cluster PRNDL display is controlled by the instrument cluster, indicating the appropriate range as transmitted to the instrument cluster by the PCM. The front electronic module (FEM) and rear electronic module (REM) both control and monitor the exterior illumination. When an exterior lamp is inoperative, the FEM or REM notify the instrument cluster over the communication network and the instrument cluster illuminates the warning center message LAMP OUT.

Possible Causes
- instrument cluster

PINPOINT TEST Y: THE INTEGRATED CIRCUIT DISPLAY IS INOPERATIVE

Test Step	Result / Action to Take
Y1 VERIFY THE INTEGRATED CIRCUIT DISPLAY OPERATION	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster display segment control II active command. Trigger the segments active command. • **Do all of the segments illuminate?**	**Yes** If the PRNDL is inoperative, REFER to Section 307-01 to continue diagnosis of the TR sensor. If the odometer is inoperative, GO to Pinpoint Test F . If the warning center display is inoperative, GO to Y2 . **No** GO to Y4 .
Y2 MONITOR THE EXTERIOR LIGHTING	

• Ignition ON. • Place the headlamp switch in the parking lamps ON position. • Monitor the exterior lighting. • **Do all the exterior lamps operate correctly?**	**Yes** GO to Y3 . **No** REFER to Section 417-01 to continue diagnosis of the exterior lamps.
Y3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND FEM AND REM SELF-TESTS	
• Retrieve the recorded REM and FEM DTCs from the continuous and on-demand self-tests. • **Are any FEM or REM DTCs recorded?**	**Yes** REFER to Section 419-10 to continue diagnosis of the DTCs. **No** GO to Y4 .
Y4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Z: The Instrument Cluster Is Inoperative

Normal Operation

With the ignition switch in the START or RUN position, the instrument cluster receives voltage from the central junction box (CJB) through circuits 15-GG14 (GN/RD) and 15-JA14 (GN/BK). When the ignition switch is in the RUN or ACC position, voltage is received from the CJB through circuit 75-GG15 (YE/GN). With the ignition switch in the OFF position, the instrument cluster receives its keep-alive voltage from the CJB through circuits 29-GG11 (OG/BU), and 29-AL12 (OG). The instrument cluster grounding is accomplished through circuit 91-GG11 (BN/RD), and circuit 31-AL11 (BK).

Possible Causes

- fuse(s)
- circuit 15-GG14 (GN/RD) open
- circuit 15-JA14 (GN/BK) open
- circuit 29-AL12 (OG) open
- circuit 29-GG11 (OG/BU) open
- circuit 31-AL11 (BK) open
- circuit 75-GG15 (YE/GN) open
- circuit 91-GG11 (BN/RD) open
- instrument cluster

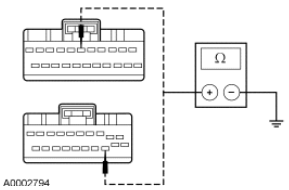
PINPOINT TEST Z: THE INSTRUMENT CLUSTER IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>Z1 CHECK THE INSTRUMENT CLUSTER VOLTAGE SUPPLY</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: Instrument Cluster C220a, C220b.
• Ignition ON.
• Measure the voltage between the instrument cluster, harness side and ground as follows:

<table><tr><th>Instrument Cluster Connector-Pin</th><th>Circuit</th></tr><tr><td>C220a-1</td><td>29-AL12 (OG)</td></tr><tr><td>C220a-11</td><td>15-JA14 (GN/BK)</td></tr><tr><td>C220b-3</td><td>29-GG11 (OG/BU)</td></tr><tr><td>C220b-6</td><td>15-GG14 (GN/RD)</td></tr><tr><td>C220b-17</td><td>75-GG15 (YE/GN)</td></tr></table>
• Is the voltage greater than 10 volts?</td><td>Yes
GO to Z2 .

No
VERIFY the CJB fuses 4 (5A), 13 (5A), 17 (5A), 19 (15A) and 20 (10A) are OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.</td></tr>
<tr><td>Z2 CHECK THE GROUND CIRCUITS</td><td></td></tr>
<tr><td>• Ignition OFF.
• Measure the resistance between the instrument cluster C220b-13, circuit 91-GG11 (BN/RD), harness side and ground; and between the instrument cluster C220a-6, circuit 31-AL11 (BK), harness side and ground.

• Are the resistances less than 5 ohms?</td><td>Yes
GO to Z4 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>Z3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION</td><td></td></tr>
<tr><td></td><td>Yes</td></tr>
</table>

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AA: The Message Center Is Not Operating Correctly

Normal Operation

The message center display is located in the instrument cluster. The message center functionality is controlled through the message center switches, which are hardwired to the instrument cluster through return circuit 7-GG25 (YE/VT) and supply circuit 9-GG11 (BN/WH). The message center switches use a different resistance value for each switch to allow the instrument cluster to determine which switch is pressed.

Possible Causes
- message center switch
- instrument cluster

PINPOINT TEST AA: THE MESSAGE CENTER IS NOT OPERATING CORRECTLY

Test Step	Result / Action to Take
AA1 CHECK THE MESSAGE CENTER DISPLAY OPERATION USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster display segment control active command and trigger the display segments active command on. Observe the message center display. • **Does the message center illuminate all segments?**	**Yes** The system is OK. If the FUEL, RESET, SETUP or STATUS buttons are inoperative, GO to Pinpoint Test AC . **No** GO to AA2 .
AA2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No

• Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test AB: The Lampout Warning Indicator Is Inoperative

Normal Operation

The front electronic module (FEM) and the rear electronic module (REM) communicate the lamp status to the instrument cluster over the communication network. The message center uses that information to indicate when a lamp is out.

Possible Causes
- instrument cluster

PINPOINT TEST AB: THE LAMPOUT WARNING INDICATOR IS INOPERATIVE

NOTE: Verify that the FEM and the REM operate correctly and communicate with the instrument cluster.

Test Step	Result / Action to Take
AB1 CHECK THE EXTERIOR LAMP OPERATION	
• Turn the headlamp switch to the headlamps ON position and monitor all the exterior lamps. • **Do all the exterior lamps operate correctly?**	**Yes** GO to AB2 . **No** REFER to Section 417-01 to continue diagnosis of the exterior lamps.
AB2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST The system for normal operation.

Pinpoint Test AC: The Message Center Switch Does Not Operate Correctly

Normal Operation

The message center switch uses circuits 7-GG25 (YE/VT) and 9-GG25 (BN/WH) to communicate the requested switch function to the instrument cluster.

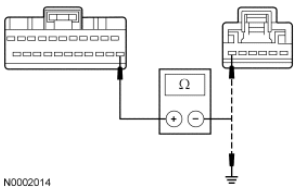
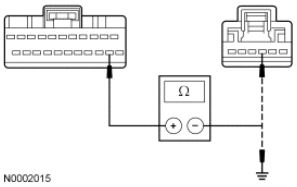
Possible Causes

- circuit 7-GG25 (YE/VT) open or short to ground
- circuit 9-GG25 (BN/WH) open or short to ground
- message center switch
- instrument cluster

PINPOINT TEST AC: THE MESSAGE CENTER SWITCH DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AC1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER SELF-TESTS	
• Retrieve the recorded instrument cluster DTCs from the continuous and on-demand self-test. • **Are any DTCs recorded?**	**Yes** If DTC B1209 is retrieved, GO to AC3 . For all other DTCs, REFER to Section 419-10 . **No** GO to AC2 .
AC2 CHECK THE MESSAGE CENTER SWITCH PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Select and monitor the instrument cluster message center switch PIDs while pressing each message center button (FUEL, RESET, SETUP and STATUS). • **Does each PID agree with each button position?**	**Yes** GO to AC5 . **No** GO to AC3 .
AC3 CHECK CIRCUIT 9-GG25 (BN/WH) FOR AN OPEN AND A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Instrument Cluster C220a. • Disconnect: Message Center Switch C253. • Measure the resistance between the instrument cluster C220a-12, circuit 9-GG25 (BN/WH), harness side and the message center switch C253-6, circuit 9-GG25 (BN/WH), harness side; and between the instrument cluster C220a-12, circuit 9-GG25 (BN/WH), harness side and ground.	**Yes** GO to AC4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0002014 • **Is the resistance less than 5 ohms between the instrument cluster and the message center switch, and greater than 10,000 ohms between the instrument cluster and ground?**	
AC4 CHECK CIRCUIT 7-GG25 (YE/VT) FOR AN OPEN AND A SHORT TO GROUND	
• Measure the resistance between the instrument cluster C220a-13, circuit 7-GG25 (YE/VT), harness side and the message center switch C253-3, circuit 7-GG25 (YE/VT), harness side; and between the instrument cluster C220a-13, circuit 7-GG25 (YE/VT), harness side and ground.  N0002015 • **Is the resistance less than 5 ohms between the instrument cluster and the message center switch, and greater than 10,000 ohms between the instrument cluster and ground?**	**Yes** INSTALL a new message center switch. REFER to Message Center Switch in this section. TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
AC5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AD: The Indicator Does Not Operate Correctly — Low Fuel Level Display

Normal Operation

The fuel level status is communicated to the instrument cluster over the communication network. The instrument cluster then communicates the fuel level status to the message center.

Possible Causes
- instrument cluster

PINPOINT TEST AD: THE INDICATOR DOES NOT OPERATE CORRECTLY — LOW FUEL LEVEL DISPLAY

Test Step	Result / Action to Take
AD1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND REAR ELECTRONIC MODULE (REM) AND INSTRUMENT CLUSTER SELF-TESTS	
NOTE: The fuel gauge does not change indication unless there have been at least 11 liters (3 gallons) of fuel added or removed between ignition switch cycles. • Retrieve the recorded REM and instrument cluster DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** If DTCs are retrieved, REFER to Section 419-10 to continue diagnosis of the DTCs. **No** GO to AD2 .
AD2 CHECK THE FUEL GAUGE OPERATION	
• Ignition ON. • Observe the fuel gauge operation. • **Does the fuel gauge operate correctly?**	**Yes** GO to AD3 . **No** GO to Pinpoint Test B to continue diagnosis of the fuel gauge.
AD3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AE: The Indicator Is Inoperative — Oil Life Status, A/C Filter Life

Normal Operation

The instrument cluster tracks the engine run time and mileage. The message center uses that information to display the remaining interval until the next recommended maintenance procedure.

Possible Causes
- odometer
- instrument cluster

PINPOINT TEST AE: THE INDICATOR IS INOPERATIVE — OIL LIFE STATUS, A/C FILTER LIFE

Test Step	Result / Action to Take
AE1 CHECK THE ODOMETER OPERATION	
• Monitor the odometer operation. • **Does the odometer operate correctly?**	**Yes** GO to AE2 . **No** GO to Pinpoint Test F to continue diagnosis of the odometer.
AE2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AF: The Indicator Does Not Operate Correctly — Low Washer Fluid Level Display

Normal Operation

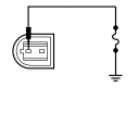
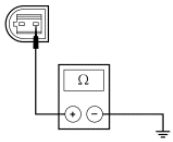
The washer fluid level switch is open when the washer fluid level is high. When the washer fluid level is low, the switch closes circuit 8-GC8 (WH/BU) with the ground circuit 31-GC8 (BK/OG) to signal the front electronic module (FEM) that the washer fluid level is low. The FEM communicates the washer fluid level status to the instrument cluster over the communication network. The message center uses that information to display the low washer fluid message.

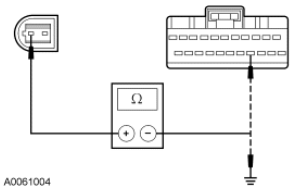
Possible Causes

- circuit 8-GC8 (WH/BU) open or short to ground
- circuit 31-GC8 (BK/OG) open
- instrument cluster
- washer fluid level switch
- FEM

PINPOINT TEST AF: THE INDICATOR DOES NOT OPERATE CORRECTLY — LOW WASHER FLUID LEVEL DISPLAY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AF1 CHECK THE LOW WASHER FLUID MESSAGE DISPLAY	
• Disconnect: Washer Fluid Level Switch C138. • Connect a fused (5A) jumper wire between the washer fluid level switch C138-2, circuit 8-GC8 (WH/BU), harness side and ground.  A0004841 • Ignition ON. • **Does the message center display LOW WASHER FLUID?**	**Yes** REMOVE the jumper wire. GO to AF2 . **No** LEAVE the jumper wire connected. GO to AF3 .
AF2 CHECK CIRCUIT 31-GC8 (BK/OG) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the washer fluid level switch C138-1, circuit 31-GC8 (BK/OG), harness side and ground.  A0004810 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new washer fluid level switch. CLEAR the diagnostic trouble codes (DTCs). REPEAT the self-test. operation. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
AF3 CHECK THE FEM PID	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: FEM Washer Fluid Level PID . • Monitor the FEM washer fluid level PID. • Remove the jumper wire. • Monitor the FEM washer fluid level PID. • **Does the PID read low with the jumper wire connected and OK with the jumper wire disconnected?**	**Yes** GO to AF5 . **No** GO to AF4 .
AF4 CHECK CIRCUIT 8-GC8 (WH/BU) FOR AN OPEN OR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the washer fluid level switch C138-2, circuit 8-GC8 (WH/BU), harness side and the FEM C201b-15, circuit 8-GC8 (WH/BU), harness side; and between the washer fluid level switch C138-2, circuit 8-GC8 (WH/BU), harness side and ground.	**Yes** GO to AF6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 • **Is the resistance less than 5 ohms between the washer fluid level switch and the FEM, and greater than 10,000 ohms between the washer fluid level switch and ground?**	
AF5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

AF6 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AG: The Indicator Does Not Operate Correctly — Low Brake Fluid Level Display

Normal Operation

The brake fluid level sensor resistance is high when the brake fluid level is high. When the brake fluid level is low, the resistance to circuit 8-GC7 (WH/RD) is low and is a signal the front electronic module (FEM) that the brake fluid level is low. The FEM communicates the brake fluid level status to the instrument cluster over the communication network. The message center uses that information to display the low brake fluid message.

Possible Causes

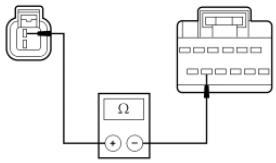
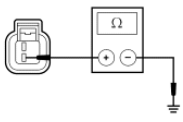
- circuit 8-GC7 (WH/RD) open

- circuit 31-GC7 (BK/BU) open
- brake fluid level sensor
- instrument cluster
- FEM

PINPOINT TEST AG: THE INDICATOR DOES NOT OPERATE CORRECTLY — LOW BRAKE FLUID LEVEL DISPLAY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AG1 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster warning lamps and chime active command. Trigger all lamps active command on and off. Observe the brake warning indicator. • **Does the brake warning indicator illuminate when triggered on, and turn off when triggered off?**	**Yes** GO to AG2 . **No** GO to AG7 .
AG2 CHECK THE BRAKE WARNING INDICATOR	
• Ignition OFF. • Ignition ON. • Monitor the brake warning indicator. • **Does the brake warning indicator continue to illuminate after prove-out?**	**Yes** REFER to Section 206-09 to continue diagnosis of the brake warning indicator. **No** GO to AG3 .
AG3 CHECK THE LOW BRAKE FLUID LEVEL DISPLAY	
• Monitor the message center for the LOW BRAKE FLUID LEVEL message. • **Is the LOW BRAKE FLUID LEVEL message always displayed?**	**Yes** GO to AG7 . **No** GO to AG4 .
AG4 CHECK THE FEM BRAKE FLUID LEVEL PID	
• Ignition OFF. • Disconnect: Brake Fluid Level Sensor C1395. • Ignition ON. • Enter the following diagnostic mode on the scan tool: FEM Brake Status PID. • Monitor the brake fluid level sensor PID. • Connect a fused (5A) jumper wire between the brake fluid level sensor C1395-1, circuit 8-GC7 (WH/RD), harness side and the brake fluid level sensor C1395-2, circuit 31-GC7 (BK/BU), harness side.	**Yes** REMOVE the jumper wire. INSTALL a new brake fluid level sensor. REFER to Section 206-06 . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to AG5 .

 A0060988 • Monitor the brake fluid level sensor PID. • **Does the PID indicate full when the jumper wire is not connected and low when the jumper wire is connected?**	
AG5 CHECK CIRCUIT 8-GC7 (WH/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: FEM C201c. • Measure the resistance between the brake fluid level sensor C1395-1, circuit 8-GC7 (WH/RD) and the FEM C201c-11, circuit 8-GC7 (WH/RD), harness side.  A0061005 • **Is the resistance less than 5 ohms?**	**Yes** GO to AG6 . **No** REPAIR the circuit. TEST the system for normal operation.
AG6 CHECK CIRCUIT 31-GC7 (BK/BU) FOR AN OPEN	
• Measure the resistance between the brake fluid level sensor C1395-2, circuit 31-GC7 (BK/BU), harness side and ground.  A0061006 • **Is the resistance less than 5 ohms?**	**Yes** GO to AG8 . **No** REPAIR the circuit. TEST the system for normal operation.
AG7 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been

• **Is the concern still present?**	caused by a loose or corroded connector.
AG8 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AH: The Indicator Does Not Operate Correctly — Door Ajar Display

Normal Operation

The front electronic module (FEM) and the rear electronic module (REM) communicate the door ajar status to the instrument cluster over the communication network. The message center uses that information to display the door ajar message.

Possible Causes
- instrument cluster

PINPOINT TEST AH: THE INDICATOR DOES NOT OPERATE CORRECTLY — DOOR AJAR DISPLAY

Test Step	Result / Action to Take
AH1 CHECK THE INTERIOR DOME LAMP OPERATION	
NOTE: The instrument panel dimmer switch must be in the DOOR position, not the COURTESY position. • Open and close each of the doors. • **Does the interior dome lamp operate correctly?**	**Yes** GO to AH2 . **No** REFER to Section 417-02 to continue diagnosis of the interior lamps.
AH2 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND FEM AND REM SELF-TESTS	
• Retrieve the recorded FEM and REM DTCs from the continuous and on-demand self-tests. • **Are any FEM or REM DTCs recorded?**	**Yes** REFER to Section 419-10 to continue diagnosis of the DTCs. **No** GO to AH3 .
AH3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
	Yes

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AI: The Indicator Does Not Operate Correctly — Traction Control

Normal Operation

The traction control indicator is an output signal that is controlled by the anti-lock brake system (ABS) module. The ABS communicates the traction control status to the instrument cluster over the communication network. The message center uses that information to display the traction control message.

Possible Causes
- instrument cluster

PINPOINT TEST AI: THE INDICATOR DOES NOT OPERATE CORRECTLY — TRACTION CONTROL

Test Step	Result / Action to Take
AI1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND ABS MODULE SELF-TESTS	
• Retrieve the recorded ABS module DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 206-09 to continue diagnosis of the DTCs. **No** GO to AI2 .
AI2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AJ: The Indicator Does Not Operate Correctly — Check Fuel Cap

Normal Operation

The check fuel cap indicator is an output signal that is controlled by the powertrain control module (PCM). When the PCM determines that there is a failure in the vapor management system due to the fuel cap not sealing correctly, the PCM communicates the fuel cap status to the instrument cluster over the communication network. The message center uses that information to display the check fuel cap message.

Possible Causes

- instrument cluster

PINPOINT TEST AJ: THE INDICATOR DOES NOT OPERATE CORRECTLY — CHECK FUEL CAP

Test Step	Result / Action to Take
AJ1 RETRIEVE AND RECORD THE DIAGNOSTIC TROUBLE CODES (DTCs) FROM THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Check for recorded PCM module DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis of the DTCs. **No** GO to AJ2 .
AJ2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AK: The Indicator Does Not Operate Correctly — Powertrain Malfunction (Wrench)

Normal Operation

The powertrain malfunction (wrench) indicator is an output signal that is controlled by the powertrain control module (PCM). The PCM communicates the powertrain malfunction (wrench) status to the instrument cluster over the communication network. The message center uses that information to display the powertrain malfunction (wrench) message.

Possible Causes

- instrument cluster

PINPOINT TEST AK: THE INDICATOR DOES NOT OPERATE CORRECTLY — POWERTRAIN MALFUNCTION (WRENCH)

Test Step	Result / Action to Take
AK1 RETRIEVE AND RECORD THE DIAGNOSTIC TROUBLE CODES (DTCs) FROM THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS	
• Retrieve the recorded PCM module DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis of the DTCs. **No** GO to AK2 .
AK2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AL: The Indicator Does Not Operate Correctly — Parking Brake

Normal Operation

The parking brake indicator is an output signal that is controlled by the electronic parking brake module. The electronic parking brake module communicates the parking brake status to the instrument cluster over the communication network. The message center uses that information to display the parking brake message.

Possible Causes

- instrument cluster

PINPOINT TEST AL: THE INDICATOR DOES NOT OPERATE CORRECTLY — PARKING BRAKE

Test Step	Result / Action to Take
AL1 RETRIEVE AND RECORD THE DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND ELECTRONIC PARKING BRAKE MODULE SELF-TESTS	
• Retrieve the recorded electronic parking brake module DTCs from the continuous and on-demand self-tests.	**Yes** REFER to Section 206-05 to continue diagnosis of the DTCs.

• **Are any DTCs recorded?**	**No** GO to AL2 .
AL2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AM: The Key-In-Ignition Chime Does Not Operate Correctly

Normal Operation

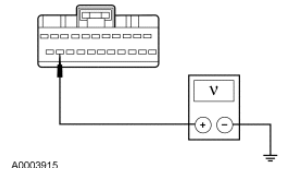
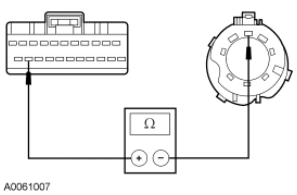
When the key is inserted into the ignition key cylinder, the key-in-ignition switch (part of the ignition switch) closes circuit 30S-GM7 (RD/WH), providing a voltage signal to the instrument cluster. The voltage input signals the instrument cluster that the key is inserted. If the instrument cluster detects that the ignition switch is in the OFF or ACC position with the key inserted in the ignition lock cylinder and the driver door is ajar, the key-in-ignition warning chime (located in the instrument cluster) sounds.

Possible Causes
- circuit 30S-GM7 (RD/WH) open
- ignition switch
- instrument cluster

PINPOINT TEST AM: THE KEY-IN-IGNITION CHIME DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AM1 CHECK THE INTERIOR DOME LAMP OPERATION	
• Verify the dome lamp switch is in the door position. • Open the driver door. • **Does the interior dome lamp illuminate when the driver door is open?**	**Yes** GO to AM2 . **No** REFER to Section 417-02 to continue diagnosis of the interior dome lamp.
AM2 CHECK THE KEY-IN-IGNITION CHIME OPERATION	
	Yes The system is operating correctly at

• Insert the ignition key with the ignition switch in the OFF position and the driver door open. • **Does the chime sound?**	this time. **No** GO to AM3 .
AM3 MONITOR THE INSTRUMENT CLUSTER KEY-IN-IGNITION PID WITH THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Monitor the instrument cluster key-in-ignition PID. • With the key in the ignition switch, the instrument cluster key-in-ignition PID should indicate yes. • **Does the instrument cluster key-in-ignition PID indicate yes?**	**Yes** GO to AM6 . **No** GO to AM4 .
AM4 CHECK CIRCUIT 30S-GM7 (RD/WH) FOR VOLTAGE	
• Remove the ignition key from the ignition lock cylinder. • Disconnect: Instrument Cluster C220a. • Insert the ignition key into the ignition lock cylinder. • Measure the voltage between the instrument cluster C220a-21, circuit 30S-GM7 (RD/WH), harness side and ground.  A0003915 • **Is the voltage greater than 10 volts?**	**Yes** GO to AM6 . **No** GO to AM5 .
AM5 CHECK CIRCUIT 30S-GM7 (RD/WH) FOR AN OPEN	
• Remove the ignition key from the ignition lock cylinder. • Disconnect: Ignition Switch C250. • Measure the resistance between the instrument cluster C220a-21, circuit 30S-GM7 (RD/WH), harness side and the ignition switch C250-8, circuit 30S-GM7 (RD/WH), harness side.  A0061007 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new ignition switch. CLEAR the diagnostic trouble codes (DTCs). REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

AM6 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AN: The Headlamps On Reminder Chime Does Not Operate Correctly

Normal Operation

The headlamps on warning chime sounds when the driver door is opened with the ignition switch in the OFF position and the key out, and the instrument cluster detects the headlamp switch is on. The headlamps on reminder chime does not operate when the autolamp feature is active.

Possible Causes
- instrument cluster

PINPOINT TEST AN: THE HEADLAMPS ON REMINDER CHIME DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
AN1 CHECK THE INTERIOR DOME LAMP OPERATION	
• Verify the dome lamp switch is in the door position. • Open the driver door. • **Does the interior dome lamp illuminate when the driver door is open?**	**Yes** GO to AN2 . **No** REFER to Section 417-02 to continue diagnosis of the interior dome lamp.
AN2 CHECK THE AUTOLAMPS OPERATION	
• Turn the autolamps OFF. • Turn the parking lamps ON. • Open the driver door. • **Does the headlamps on reminder chime sound?**	**Yes** The system is operating correctly at this time. **No** GO to AN3 .
AN3 CHECK THE EXTERIOR LAMPS OPERATION	
• Turn the parking lamps ON.	**Yes** GO to AN4 .

• Turn the headlamps ON. • **Do the exterior lamps operate correctly?**	**No** REFER to Section 417-01 to continue diagnosis of the exterior lamps.
AN4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test AO: The Air Bag Warning Chime Does Not Operate Correctly

Normal Operation

The instrument cluster receives the air bag warning chime input from the restraints control module (RCM) through circuit 8-GE52 (WH/BK). The instrument cluster sounds the air bag warning chime when it detects a ground from the RCM on circuit 8-GE52 (WH/BK).

Possible Causes
- instrument cluster
- RCM

PINPOINT TEST AO: THE AIR BAG WARNING CHIME DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
AO1 RETRIEVE THE RCM RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded RCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 501-20B to continue diagnosis of the RCM. **No** GO to AO2 .
AO2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors.	**Yes** INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST

• Check for: • corrosion • pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test AP: The Fail Safe Cooling Chime Does Not Operate Correctly

Normal Operation

The powertrain control module (PCM) communicates the fail safe cooling status to the instrument cluster over the communication network.

Possible Causes
- instrument cluster

PINPOINT TEST AP: THE FAIL SAFE COOLING CHIME DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
AP1 RETRIEVE THE PCM RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded PCM DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis. **No** GO to AP2 .
AP2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: • corrosion • pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test AQ: The Turn Signal Warning Chime Does Not Operate Correctly

Normal Operation

The instrument cluster sounds the turn signal warning chime when the turn signals have been activated for a distance greater than 0.8 km (0.5 miles).

Possible Causes

- instrument cluster

PINPOINT TEST AQ: THE TURN SIGNAL WARNING CHIME DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
AQ1 CHECK THE OPERATION OF THE TURN SIGNALS	
• Ignition ON. • Operate the turn signals. • Turn the steering wheel in both directions, with the turn signals activated, to check the turn signal canceling function. • **Do the turn signals operate correctly?**	**Yes** GO to AQ2 . **No** REFER to Section 417-01 to continue diagnosis of the turn signals.
AQ2 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test AR: The Electronic Parking Brake Warning Chime Does Not Operate Correctly

Normal Operation

The instrument cluster momentarily sounds the electronic parking brake warning chime when the parking brake is applied and again when the parking brake is released. The electronic parking brake module communicates the parking brake status to the instrument cluster over the communication network.

Possible Causes

- instrument cluster

PINPOINT TEST AR: THE ELECTRONIC PARKING BRAKE WARNING CHIME DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
AR1 RETRIEVE THE ELECTRONIC PARKING BRAKE MODULE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded electronic parking brake module DTCs from the continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to Section 206-05 to continue diagnosis of electronic parking brake module. **No** GO to AR2 .
AR2 CHECK THE OPERATION OF THE ELECTRONIC PARKING BRAKE CHIME	
• Ignition ON. • Apply the parking brake. • Release the parking brake. • **Does the electronic parking brake chime sound when the parking brake is applied and again when the parking brake is released?**	**Yes** The system is operating correctly at this time. **No** GO to AR3 .
AR3 CHECK THE OPERATION OF THE ELECTRONIC PARKING BRAKE USING THE DIAGNOSTIC TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Electronic Parking Brake Module PIDs. • Monitor the parking brake switch PIDs. • Apply the parking brake. • Release the parking brake. • **Do the parking brake switch PIDs agree with the parking brake positions?**	**Yes** GO to AR4 . **No** REPAIR the electronic parking brake. REFER to Section 206-05 .
AR4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test AS: The Chime Sounds When The Driver Door Is Ajar (No Key In Ignition And Headlamps Off)

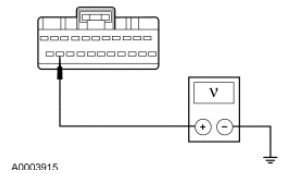
Normal Operation

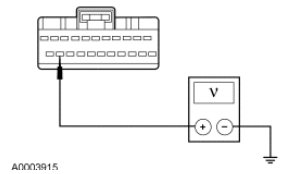
The instrument cluster sounds the warning chime when the driver door is open and the ignition switch is in the OFF position or the headlamps are left on.

Possible Causes
- circuit 30S-GM7 (RD/WH) short to voltage
- key-in-ignition switch (part of the ignition switch)
- headlamp switch
- instrument cluster

PINPOINT TEST AS: THE CHIME SOUNDS WHEN THE DRIVER DOOR IS AJAR (NO KEY IN IGNITION AND HEADLAMPS OFF)

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AS1 CHECK CIRCUIT 30S-GM7 (RD/WH) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Instrument Cluster C220a. • Measure the voltage between the instrument cluster C220a-21, circuit 30S-GM7 (RD/WH), harness side and ground.  A0003915 • **Is any voltage present?**	**Yes** GO to AS2 . **No** GO to AS3 .
AS2 CHECK THE KEY-IN-IGNITION SWITCH OPERATION	
• Ignition OFF. • Disconnect: Ignition Switch C250. • Measure the voltage between the instrument cluster C220a-21, circuit 30S-GM7 (RD/WH), harness side and ground.	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new ignition switch. REFER to Section 211-05 . TEST the system for normal operation.

 • **Is any voltage indicated?**	
AS3 CHECK THE EXTERIOR LAMPS OPERATION	
• Turn the parking lamps ON. • Turn the headlamps ON. • **Do the exterior lamps operate correctly?**	**Yes** GO to AS4 . **No** REFER to Section 417-01 to continue diagnosis of the exterior lamps.
AS4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test AT: Incorrect Speedometer Indication

Normal Operation

Vehicle speed information is sent to the instrument cluster by the powertrain control module (PCM) over the communication network. The PCM calculates vehicle speed from the transmission output shaft speed (OSS) sensor input. Factors that could affect the speedometer indication are tire size.

- Tire size
- PCM concern
- instrument cluster

PINPOINT TEST AT: INCORRECT SPEEDOMETER INDICATION

NOTE: It is important to confirm that the speedometer is inaccurate by either comparing vehicle speed against mile markers on highways (where available) or by comparison using a second vehicle before beginning diagnostics.

Test Step	Result / Action to Take
AT1 CHECK THE VEHICLE TIRE SIZE	

• Using the certification label located in the LH front door area, verify that the vehicle is equipped with the correct tire size. Refer to Section 100-01 . • **Does the tire size match the certification label?**	**Yes** GO to AT2 . **No** INFORM the customer that tire size affects the accuracy of the speedometer.
AT2 RETRIEVE THE RECORDED DTCs FROM THE POWERTRAIN CONTROL MODULE (PCM) KEY ON ENGINE OFF (KOEO) SELF-TEST	
• Check for recorded PCM DTCs from the KOEO self-test. • **Are any DTCs recorded?**	**Yes** DIAGNOSE all PCM DTCs first. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to AT3 .
AT3 RETRIEVE THE RECORDED DTCs FROM THE INSTRUMENT CLUSTER SELF-TEST	
• Check for recorded DTCs from the instrument cluster self-test. • **Are any DTCs recorded?**	**Yes** REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index in this section. **No** GO to AT4 .
AT4 OBSERVE THE SPEEDOMETER OPERATION	
• Ignition ON. • Observe the speedometer while driving the vehicle at various speeds and stopping frequently. • **Does the speedometer begin at 0 km/h (0 mph), indicate the different vehicle speeds and fully return to the 0 km/h (0 mph) position when the vehicle is stopped?**	**Yes** GO to AT5 . **No** INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
AT5 CARRY OUT THE INSTRUMENT CLUSTER SPEEDOMETER ACTIVE COMMAND	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Select the instrument cluster speedometer command active command. • Trigger the speedometer and scroll in increments of 10%. Monitor the speedometer gauge. The speedometer should be increasing in increments of 26 km/h (16 mph) for every 10%. • **Does the speedometer indicate approximately within specification?**	**Yes** GO to AT6 . **No** GO to AT7 .
AT6 CHECK THE PCM VEHICLE SPEED SIGNAL	
• Enter the following diagnostic mode on the scan tool: PCM DataLogger.	**Yes** The speedometer is operating correctly at this time.

• Select the PCM vehicle speed (VSS) PID and monitor the PID while driving the vehicle at 32 km/h (20 mph), 64 km/h (40 mph) and 97 km/h (60 mph). • **Does the speedometer indicate between 31-34 km/h (19-21 mph), 63-69 km/h (39-43 mph) and 93-103 km/h (58-64 mph) at the 3 PCM PID values?**	**No** GO to AT7 .
AT7 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Belt-Minder® Deactivating/Activating

Preparation

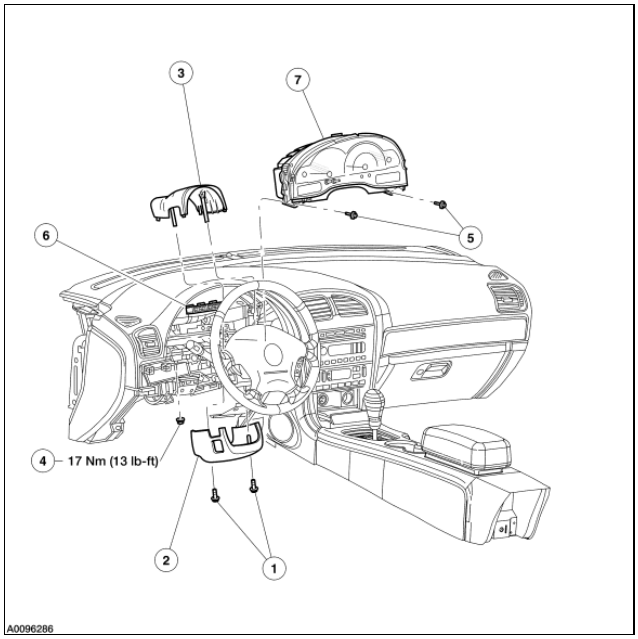
1. Apply the parking brake before deactivating/activating the safety belt minder.
2. Place the gear selector lever in PARK or NEUTRAL (manual transmission).
3. Place the ignition lock cylinder in the OFF position.
4. Close all the vehicle doors.
5. Unbuckle the driver and the front passenger safety belts.

Deactivating/Activating

1. Turn the ignition lock cylinder to the ON position (do not start the engine).
2. Wait until the safety belt warning lamp turns off (approximately 1 minute).
3. **NOTE:** Step 3 must be completed within 50 seconds after the safety belt warning indicator turns off.

   For the seating position being disabled, at a moderate speed, buckle then unbuckle the safety belt 9 times, ending with the safety belt in the unbuckled state. After this step the safety belt warning indicator illuminates for 3 seconds.
4. Within 10 seconds of the safety belt warning indicator turning on, at a moderate speed, buckle then unbuckle the safety belt.
   - This disables the safety belt minder feature for that seating position, if it is currently enabled. As confirmation, the safety belt warning indicator flashes 4 times per second for 3 seconds.
   - This enables the safety belt minder feature for that seating position, if it is currently disabled. As confirmation, the safety belt warning indicator flashes 4 times per second for 3 seconds, followed by 3 seconds with the indicator off, then the safety belt warning indicator flashes 4 times per second for 3 seconds again.
5. After confirmation, the deactivation/activation procedure is complete.

Instrument Cluster (IC)



Item	Part Number	Description
1	504246	Steering column shroud screws (2 required)
2	3530B	Lower steering column shroud
3	3530A	Upper steering column shroud
4	700390	Steering column nuts (4 required)
5	805589	Instrument cluster screws (4 required)
6	—	Instrument cluster electrical connectors (part of 14401)(2 required)
7	10849	Instrument cluster

Removal and Installation

NOTE: Prior to removal of the Instrument Cluster (IC), it is necessary to upload the IC configuration information to the diagnostic tool. This information needs to be downloaded into the new IC once installed. For additional information, refer to Section 418-01 .

NOTE: If either the IC or the powertrain control module (PCM) is installed, updated, or configured, both modules require a parameter reset to allow both modules to recognize the passive anti-theft system (PATS) keys.

Failure to carry out the parameter reset to both the IC and the PCM may result in a no start condition.

NOTE: If installing a new IC , all vehicle keys are erased during the parameter reset procedure. Verify at least 2 of the vehicle keys are available prior to carrying out this procedure.

1. Tilt the steering column to the lowest position and telescope (extend) the steering column to the farthest position.

2. Disconnect the battery. For additional information, refer to Section 414-01 .

3. Remove the instrument panel cluster finish panel. For additional information, refer to Section 501-12 .

4. Remove the instrument panel steering column cover and reinforcement. For additional information, refer to Section 501-12 .

5. Remove the 2 screws and the upper and lower steering column shrouds.

6. Loosen the 4 steering column nuts.
   - To install, tighten to 17 Nm (13 lb-ft).

7. Remove the 4 instrument cluster screws.
   - ***NOTICE:*** **To avoid damage to the instrument cluster lens, place a protective cloth over the upper steering column before removing the instrument cluster.**

     Pull the instrument cluster out from the instrument panel and disconnect the 2 electrical connectors.

8. To install, reverse the removal procedure.
   - Download the module configuration information from the diagnostic tool into the new instrument cluster. For additional information, refer to Section 418-01 .

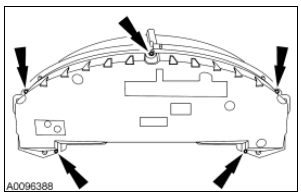
9. Following installation of the instrument cluster, carry out the Parameter Reset and Key Programming procedure in this section.
   The parameter reset must also be carried out for the PCM. For additional PCM information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Warning Indicator Bulb

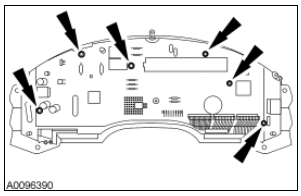
Removal and Installation

1. Remove the instrument cluster. For additional information, refer to Instrument Cluster (IC) in this section.

2. Remove the 5 screws and the rear cover.

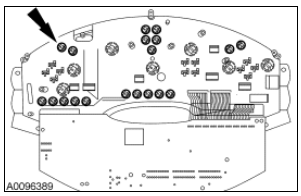


3. Remove the 6 screws and position the circuit board aside.



4. **NOTE:** To remove a warning indicator bulb, rotate the bulb one quarter turn counterclockwise and lift it straight out from the instrument cluster.

   Remove the warning indicator bulb in question.



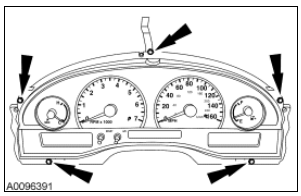
5. To install, reverse the removal procedure.

Instrument Cluster (IC) Lens

Removal and Installation

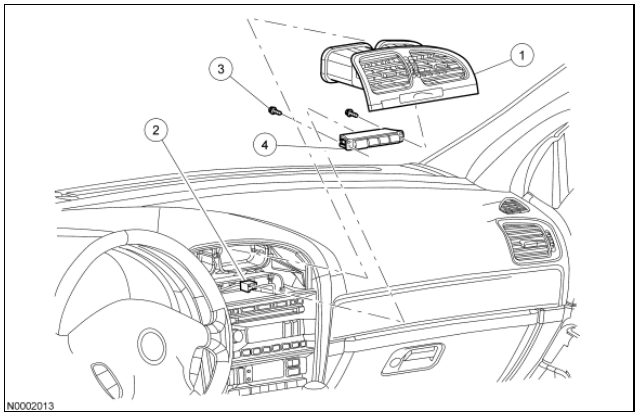
1. Remove the instrument cluster. For additional information, refer to Instrument Cluster (IC) in this section.

2. Remove the 5 screws and the lens.



3. To install, reverse the removal procedure.

Message Center Switch



Item	Part Number	Description
1	19893	Instrument panel center register panel
2	—	Message center switch electrical connector (part of 14401)
3	701678	Message center switch screws (2 required)
4	10D996	Message center switch

Removal and Installation

1. **NOTE:** The instrument panel center register panel is held in place by spring clips located on the panel.

   Remove the instrument panel center register panel.

   - Disconnect the message center switch electrical connector.

2. Remove the 2 screws and the message center switch.

3. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Horn bolt	20	15	—
Horn switch pad bolts	6	—	53

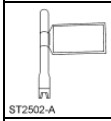
Horn

There are 3 separate conditions that can cause the horn to sound. The horn sounds if the driver presses the horn pad, when the remote keyless entry is armed, or during an anti-theft event. The horn system uses a horn relay to provide voltage to the horns while the horn switches and the front electronic module (FEM) provide the control grounds to engage the horn relay. The horn switch is located behind the driver air bag module. For the removal and installation of the horn switch, refer to Horn Switch in this section. The FEM is located behind the LH A-pillar lower trim panel. For removal and installation of the FEM, refer to Section 419-10 .

Horn

Refer to Wiring Diagrams Cell 44 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2502-A	Diagnostic Tool, Restraint System (2 required) 418-F395 (014-R1079)
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

When the horn switch is pressed, a message is sent from the instrument cluster over the network communication link to the front electronic module (FEM). The FEM acknowledges the message and energizes the horn relay by grounding the horn relay coil which allows the dual-note horn to sound.

Inspection and Verification

NOTE: The instrument cluster and the FEM must be reconfigured upon installation. Refer to Section 418-01 .

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Horns • Horn switches	• Central junction box (CJB) fuse 20 (10A) • Auxiliary junction box (AJB) fuse 4

• Horn relay • Clockspring	(20A) • Circuitry • Horn relay • Clockspring	

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for the instrument cluster, refer to Section 413-01 .
   - No response/not equipped for the FEM, refer to Section 419-10 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out self-test diagnostics for the instrument cluster and the FEM.

7. If the DTCs retrieved are related to the concern, refer to Section 419-10 .

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Horn is Inoperative

Normal Operation

The horn switch is grounded through the clockspring by circuit 31-GJ1 (BK/BU). The clockspring provides this ground signal to the instrument cluster through the horn switch on circuit 10-GJ9 (GY/OG). The horn relay control and switched voltage circuits are supplied by the auxiliary junction box (AJB) fuse 4 (20A) through circuit 30-GJ7 (RD/BU). The horn relay ground is controlled by the front electronic module (FEM) through circuit 91S-GJ7 (BN/RD). When the horn switch is pressed, the instrument cluster sends the FEM a command signal over the communication network to ground the horn relay. The FEM supplies a ground, energizing the horn relay and supplying voltage to the horn through circuit 30S-GJ6 (RD/YE).

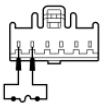
Possible Causes

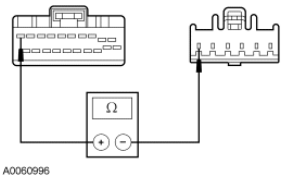
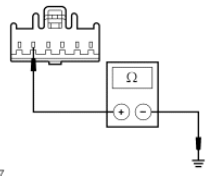
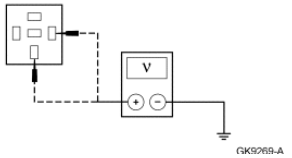
- fuse(s)
- circuit 10-GJ9 (GY/OG) open
- circuit 30-GJ7A (RD/BU) open
- circuit 30-GJ7B (RD/BU) open
- circuit 30S-GJ6 (RD/YE) open
- circuit 31-GJ1 (BK/BU) open
- circuit 31-GJ6 (BK/YE) open
- circuit 91S-GJ7 (BN/RD) open
- horn relay
- horn switch
- horn
- clockspring
- FEM
- instrument cluster

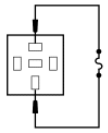
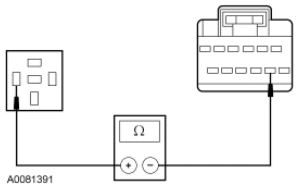
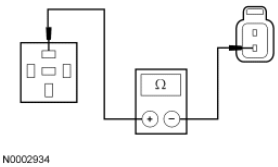
PINPOINT TEST A: THE HORN IS INOPERATIVE

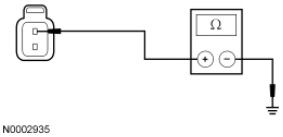
⚠ **CAUTION: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.**

Test Step	Result / Action to Take
A1 CHECK THE HORN INPUT PID TO THE INSTRUMENT CLUSTER	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Monitor the instrument cluster horn switch PID while pressing and releasing the horn switch pad. • **Does the PID indicate ON with the horn switch pad pressed, and OFF with the horn switch pad released?**	**Yes** GO to A2 . **No** GO to A3 .
A2 INITIATE THE HORN CONTROL ACTIVE COMMAND	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • Trigger the FEM HORN CONTROL active command. • **Does the horn sound?**	**Yes** GO to A13 . **No** GO to A7 .
A3 CHECK THE OPERATION OF THE HORN SWITCH	
• Ignition OFF. • Remove the driver air bag module. Refer to Section 501-20B . • Connect the 2 restraint system diagnostic tools (418-F395) to the upper clockspring.	**Yes** REMOVE the jumper wire. INSTALL a new horn switch. REFER to Horn Switch in this section. DISCONNECT the battery. INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation.

• **⚠ WARNING: Make sure there is no one inside the vehicle and there is nothing blocking or set in front of any air bag module when the battery is connected. Failure to follow these instructions may result in personal injury.** • Connect the battery. • Disconnect: Upper Clockspring Connector. • Connect a fused (5A) jumper wire between the upper clockspring pin 5, component side and the upper clockspring pin 6, component side. A0060994 • **Does the horn sound?**	**No** REMOVE the jumper wire. GO to A4 .
A4 CHECK THE OPERATION OF THE CLOCKSPRING	
• Disconnect: Clockspring C218b. • Connect a fused (5A) jumper wire between the clockspring C218b-6, circuit 10-GJ9 (GY/OG), harness side and the clockspring C218b-5, circuit 31-GJ1 (BK/BU), harness side.  A0060995 • **Does the horn sound?**	**Yes** REMOVE the jumper wire. DISCONNECT the battery. INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to A5 .
A5 CHECK CIRCUIT 10-GJ9 (GY/OG) FOR AN OPEN	
• Disconnect the battery. • Install the driver air bag module. Refer to Section 501-20B . • Disconnect: Instrument Cluster C220b. • Measure the resistance between the instrument cluster C220b-10, circuit 10-GJ9 (GY/OG), harness side and the clockspring C218b-6, circuit 10-GJ9 (GY/OG), harness side.	**Yes** GO to A6 . **No** REPAIR the circuit. TEST the system for normal operation.

 A0060996 • **Is the resistance less than 5 ohms?**	
A6 CHECK CIRCUIT 31-GJ1 (BK/BU) FOR AN OPEN	
• Measure the resistance between the clockspring C218b-5, circuit 31-GJ1 (BK/BU), harness side and ground.  A0060997 • **Is the resistance less than 5 ohms?**	**Yes** GO to A13 . **No** REPAIR the circuit. TEST the system for normal operation.
A7 CHECK THE OPERATION OF THE HORN RELAY	
• Ignition OFF. • Disconnect: Horn Relay C1006. • Carry out the horn relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the horn relay OK?**	**Yes** GO to A8 . **No** INSTALL a new horn relay. TEST the system for normal operation.
A8 CHECK CIRCUITS 30-GJ7A (RD/BU) AND 30-GJ7B (RD/BU) FOR AN OPEN	
• Measure the voltage between the horn relay C1006-30, circuit 30-GJ7A (RD/BU), harness side and ground; and between the horn relay C1006-86, circuit 30-GJ7B (RD/BU), harness side and ground.  GK9269-A • **Are the voltages greater than 10 volts?**	**Yes** GO to A9 . **No** VERIFY the AJB fuse 4 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
A9 CHECK THE HORN OPERATION	

• Connect a fused (5A) jumper wire between the horn relay C1006-87, circuit 30S-GJ6 (RD/YE), harness side and the horn relay C1006-30, circuit 30-GJ7A (RD/BU), harness side.  A0060999 • **Does the horn sound?**	**Yes** REMOVE the jumper wire. GO to A10 . **No** REMOVE the jumper wire. GO to A11 .
A10 CHECK CIRCUIT 91S-GJ7 (BN/RD) FOR AN OPEN	
• Disconnect: FEM C201c. • Measure the resistance between the horn relay C1006-85, circuit 91S-GJ7 (BN/RD), harness side and the FEM C201c-8, circuit 91S-GJ7 (BN/RD), harness side.  A0081391 • **Is the resistance less than 5 ohms?**	**Yes** GO to A14 . **No** REPAIR the circuit. TEST the system for normal operation.
A11 CHECK CIRCUIT 30S-GJ6 (RD/YE) FOR AN OPEN	
• Disconnect: Horn C131. • Measure the resistance between the horn relay C1006-87, circuit 30S-GJ6 (RD/YE), harness side and the horn C131-2, circuit 30S-GJ6 (RD/YE), harness side.  N0002934 • **Is the resistance less than 5 ohms?**	**Yes** GO to A12 . **No** REPAIR the circuit. TEST the system for normal operation.
A12 CHECK CIRCUIT 31-GJ6 (BK/YE) FOR AN OPEN	

• Measure the resistance between the horn C131-1, circuit 31-GJ6 (BK/YE), harness side and ground.  N0002935 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new horn. REFER to Horn in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A13 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

A14 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The Horn is Always On

Normal Operation

The horn switch is grounded through the clockspring by circuit 31-GJ1 (BK/BU). The clockspring provides this ground signal to the instrument cluster through the horn switch on circuit 10-GJ9 (GY/OG). The horn relay control and switched voltage circuits are supplied by the auxiliary junction box (AJB) fuse 4 (20A) through circuit 30-GJ7 (RD/BU). The horn relay ground is controlled by the front electronic module (FEM) through circuit 91S-GJ7 (BN/RD). When the horn switch pad is pressed, the instrument cluster sends the FEM a command signal over the communication network to ground the horn relay. The FEM supplies a ground, energizing the horn relay and supplying voltage to the horn through circuit 30S-GJ6 (RD/YE).

Possible Causes

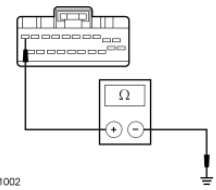
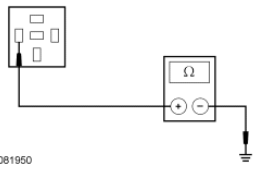
- circuit 10-GJ9 (GY/OG) short to ground

- circuit 30S-GJ6 (RD/YE) short to voltage
- circuit 91S-GJ7 (BN/RD) short to ground
- clockspring
- horn relay
- horn switch
- FEM
- instrument cluster

PINPOINT TEST B: THE HORN IS ALWAYS ON

⚠ CAUTION: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step	Result / Action to Take
B1 CHECK THE HORN INPUT PID FROM THE INSTRUMENT CLUSTER	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Monitor the instrument cluster horn switch PID. • **Does the PID always indicate ON?**	**Yes** GO to B2 . **No** GO to B5 .
B2 CHECK THE HORN SWITCH OPERATION	
• Ignition OFF. • Remove the drive air bag module. Refer to Section 501-20B . • Connect the 2 restraint system diagnostic tools (418-F395) to the upper clockspring. • **⚠ WARNING: Make sure there is no one inside the vehicle and there is nothing blocking or set in front of any air bag module when the battery is connected. Failure to follow these instructions may result in personal injury.** • Connect the battery. • Disconnect: Upper Clockspring. • **Does the horn stop sounding?**	**Yes** INSTALL a new horn switch. REFER to Horn Switch in this section. DISCONNECT the battery. INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation. **No** GO to B3 .
B3 CHECK THE CLOCKSPRING OPERATION	
• Disconnect: Clockspring C218b. • **Does the horn stop sounding?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . DISCONNECT the battery. INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation. **No** GO to B4 .
B4 CHECK CIRCUIT 10-GJ9 (GY/OG) FOR A SHORT TO GROUND	

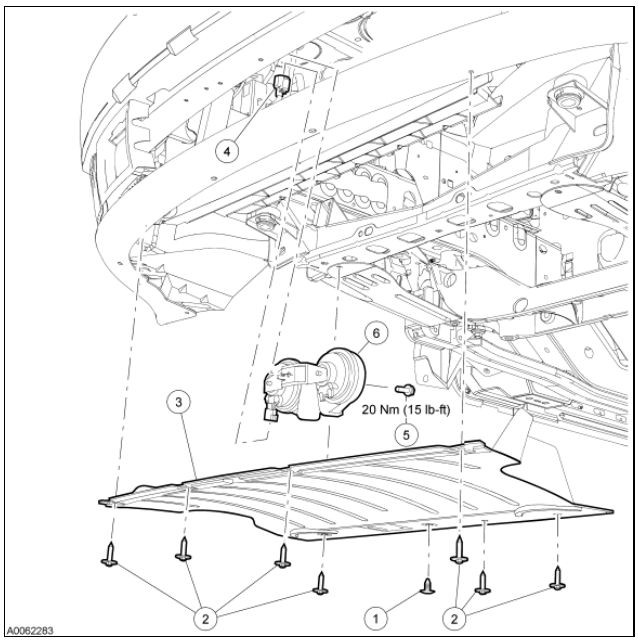
• Connect: Upper Clockspring. • Disconnect the battery. • Install the driver air bag module. Refer to Section 501-20B . • Disconnect: Instrument Cluster C220b. • Measure the resistance between the instrument cluster C220b-10, circuit 10-GJ9 (GY/OG), harness side and ground.  A0061002 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B9 . **No** REPAIR the circuit. TEST the system for normal operation.
B5 CHECK CIRCUIT 30S-GJ6 (RD/YE) FOR A SHORT TO VOLTAGE	
• Disconnect: Horn Relay C1006. • **Does the horn stop sounding?**	**Yes** GO to B6 . **No** REPAIR the circuit. TEST the system for normal operation.
B6 CHECK THE HORN RELAY OPERATION	
• Ignition OFF. • Disconnect: Horn Relay C1006. • Carry out the horn relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the horn relay OK?**	**Yes** GO to B7 . **No** INSTALL a new horn relay. TEST the system for normal operation.
B7 CHECK CIRCUIT 91S-GJ7 (BN/RD) FOR A SHORT TO GROUND	
• Disconnect: FEM C201c. • Measure the resistance between the horn relay C1006-85, circuit 91S-GJ7 (BN/RD), harness side and ground.  A0081950 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B8 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

B9 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Horn



Item	Part Number	Description
1	389358	Front splash shield pin-type retainer
2	N801603	Front splash shield bolts (7 required)
3	17626	Front splash shield
4	14290	Horn electrical connector
5	W705661	Horn bolt
6	13832	Horn

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

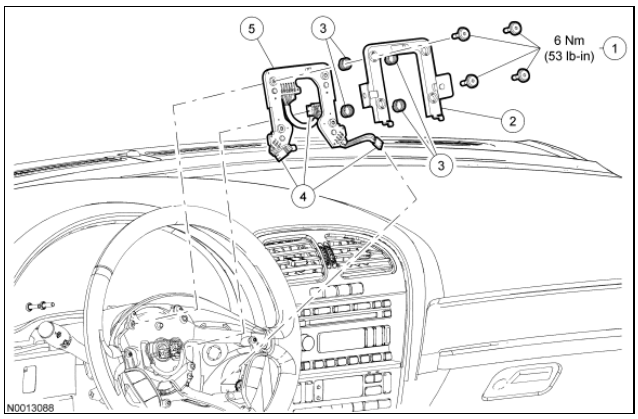
2. Remove the front splash shield
   - Remove the 7 bolts.
   - Remove the pin type retainer.

3. Disconnect the horn electrical connector.

4. Remove the bolt and the horn.
   - To install, tighten to 20 Nm (15 lb-ft).

5. To install, reverse the removal procedure.

Horn Switch



Item	Part Number	Description
1	—	Horn switch pad bolts (part of 13A875) (4 required)
2	—	Horn switch pad (part of 13A875)
3	—	Horn switch springs (part of 13A875) (4 required)
4	—	Horn switch electrical connectors (part of 13A875)
5	13A875	Horn switch

Removal and Installation

1. Remove the driver air bag module. For additional information, refer to Section 501-20B .

2. **NOTE:** The 4 horn switch springs are not attached. To avoid losing the springs, use caution when removing the horn switch.

   Remove the horn switch.

   1. Remove the 4 horn switch plate bolts.
      - ♦ To install, tighten to 6 Nm (53 lb-in).
   2. Remove the horn switch plate and the 4 horn switch springs.
   3. Disconnect the horn switch electrical connectors and remove the horn switch.

3. To install, reverse the removal procedure.

General Specifications

Item	Specification
Azimuth system check object positions 1 (P1) and position 5 (P5) distance from sensor	160 cm (63 in)
Azimuth system check object positions 2 (P2), 3 (P3), and 4 (P4) distance from sensor	5 m (16.4 ft)

Parking Aid

The parking aid system sounds a warning to alert the driver of stationary objects near the rear bumper when the REVERSE gear is selected. The parking aid system assists the driver in detecting certain objects while the vehicle moves slowly in REVERSE as follows: at speeds less than 5 km/h (3 mph), the maximum range for detection is 3.5 meters (11.5 ft), at speeds more than 5 km/h (3 mph), the maximum range for detection is 5 meters (16.4 ft). The parking aid system may not detect angular or moving objects.

Parking Aid

Refer to Wiring Diagrams Cell 131 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

The parking aid system detects objects behind the vehicle when the vehicle is in REVERSE. The parking aid does this by calculating the distance to an object by the use of 2 ultrasonic sensors and 1 radar sensor mounted in the rear bumper. The field is emitted in a semicircular area around the rear of the vehicle. The sensors can detect objects up to 5 meters (16.4 ft) to the rear of the vehicle, 50 cm (1.6 ft) to the rear side of the vehicle, and 16 cm (6 in) above the ground. A 750 Hz variable warning tone is generated by the parking aid module speaker integrated in the parking aid module. The speaker increases its warning tone rate as the vehicle gets closer to an obstacle. When an object is detected within 45 cm (18 in) of the sensors, the warning tone becomes continuous.

The system always enables when the ignition switch is turned to the RUN position and REVERSE gear is selected. The parking aid system is disabled if any fault is detected. The parking aid disable switch indicator illuminates for 2 seconds when the ignition switch is turned to the RUN position and no fault is detected. If any fault is detected, the parking aid disable switch indicator flashes, then constantly illuminates when the ignition switch is turned to the RUN position. The parking aid is on the universal asynchronous receiver-transmitter (UART)-based protocol (UBP) communications network, and can be diagnosed with a diagnostic tool.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Central junction box (CJB) fuse 29 (5A) • Circuitry • Parking aid disable switch • Parking aid module • Parking aid sensors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for the parking aid module, GO to Pinpoint Test A .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out the self-test diagnostics for the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Parking Aid Module Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Parking Aid Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1299	Power Supply Sensor Circuit Short to Ground	Parking Aid Module	GO to Pinpoint Test C .
B1342	ECU is Defective	Parking Aid Module	CLEAR the DTCs. REPEAT the parking aid module self-test. If DTC B1342 is retrieved again, INSTALL a new parking aid module. REFER to Parking Aid Module in this section. CLEAR the DTCs. REPEAT the self-test.
B1627	PRNDL Reverse Input Circuit Failure	Parking Aid Module	GO to Pinpoint Test F .
B2844	Ignition Voltage Out of Range	Parking Aid Module	CLEAR the DTCs. REPEAT the parking aid module self-test. If DTC B2844 is retrieved again, REFER to Section 414-00 for charging system diagnosis.

C1700	Left Rear Sensor Circuit Failure or Blockage	Parking Aid Module	CLEAN the rear bumper and sensors with high-pressure water. CLEAR the DTCs. REPEAT the self-test. If the DTC resets, GO to Pinpoint Test C .
C1703	Right Rear Sensor Circuit Failure or Blockage	Parking Aid Module	CLEAN the rear bumper and sensors with high-pressure water. CLEAR the DTCs. REPEAT the self-test. If the DTC resets, GO to Pinpoint Test C .
C1983	Radar Sensor Fault	Parking Aid Module	CLEAN the rear bumper and sensors with high-pressure water. CLEAR the DTCs. REPEAT the self-test. If the DTC resets, INSTALL a new parking aid radar sensor. REFER to Parking Aid Sensor in this section. CLEAR the DTCs. REPEAT the self-test.
C1984	Radar Sensor Circuit Failure	Parking Aid Module	GO to Pinpoint Test D .
C1985	Parking Aid Disable Switch Stuck Low	Parking Aid Module	GO to Pinpoint Test E .
C1992	Vehicle Speed Circuit Failure	Parking Aid Module	GO to Pinpoint Test G .

Parameter Identification (PID) Index

Parameter Identification (PID) Index

PID	Description
CTR_DIST	Center radar distance
LR_CNRD LRO_DIST	Left rear outer sensor distance to object
RR_CNRD RRO_DIST	Right rear outer sensor distance to object
LR_CNRT LRO_ATTEN	Left rear outer sensor attenuation
RR_CNRT RRO_ATTEN	Right rear outer sensor attenuation

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: No Communication With The Parking Aid Module

Normal Operation

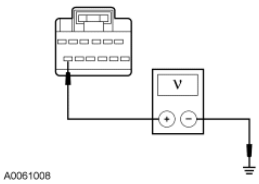
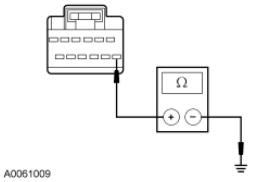
The parking aid module communicates with the diagnostic tool through circuit 4-GN10 (GY). Voltage is supplied to the parking aid module on circuit 20-GN10 (PK/YE). The parking aid module is grounded through circuit 91-GN10 (BN).

Possible Causes

- fuse
- circuit 20-GN10 (PK/YE) open
- circuit 91-GN10 (BN) open
- parking aid module

PINPOINT TEST A: NO COMMUNICATION WITH THE PARKING AID MODULE

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
A1 CHECK CIRCUIT 20-GN10 (PK/YE) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Parking Aid Module C4014b. • Ignition ON. • Measure the voltage between the parking aid module C4014b-12, circuit 20-GN10 (PK/YE), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY the central junction box (CJB) fuse 29 (5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
A2 CHECK CIRCUIT 91-GN10 (BN) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the parking aid module C4014b-7, circuit 91-GN10 (BN), harness side and ground.  	**Yes** REFER to Section 418-00 to continue diagnosis of the communication network. **No** REPAIR the circuit. TEST the system for normal operation.

• **Is the resistance less than 5 ohms?**	

Pinpoint Test B: The Parking Aid Is Inoperative/Does Not Operate Correctly

Normal Operation

The parking aid system is enabled when the ignition switch is in the RUN position and REVERSE gear is selected. The system can be enabled/disabled through the parking aid disable switch. The parking aid module sends a reference voltage to the parking aid disable switch on circuit 8-GN12 (WH/BU). The parking aid module senses when the parking aid disable switch is closed to ground.

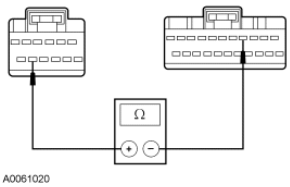
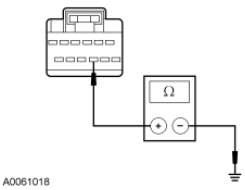
Possible Causes

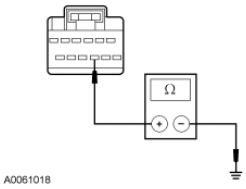
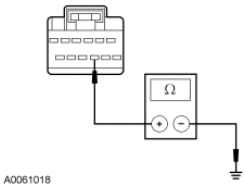
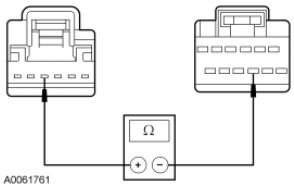
- circuit 8-GN11 (WH/RD) open
- circuit 8-GN12 (WH/BU) open or short to ground
- circuit 31-GN12 (BK/OG) open
- sensor alignment
- parking aid sensor
- parking aid module
- parking aid disable switch
- bumper cover

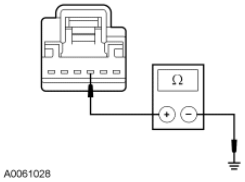
PINPOINT TEST B: THE PARKING AID IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

⚠ **CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
B1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND PARKING AID MODULE SELF-TESTS	
• Check the recorded parking aid module DTCs from the continuous and on-demand self-tests. • **Are any parking aid module DTCs recorded?**	**Yes** REFER to the Parking Aid Diagnostic Trouble Code (DTC) Index. **No** GO to B2 .
B2 CHECK THE PARKING AID SENSORS FOR CORRECT ALIGNMENT	
NOTE: If the vehicle was in an accident, the parking aid sensors may not be aligned correctly. • Check the bumper for correct alignment. • Check the parking aid sensors and holders for correct adjustment. Refer to Azimuth System Check and Elevation System Check in this section. • **Are the bumper and parking aid sensors**	**Yes** GO to B3 . **No** REALIGN or INSTALL a new bumper cover. REFER to Section 501-19 . If the vehicle was in an accident, further body work may be required to bring the parking aid sensors into correct alignment.

correctly aligned?	
B3 CHECK THE REVERSING LAMPS OPERATION	
• Apply the parking brake. • Ignition ON. • Select REVERSE. • Check the reversing lamps operation. • **Do the reversing lamps operate correctly?**	**Yes** GO to B4 . **No** REFER to Section 417-01 to continue diagnosis of the reversing lamps.
B4 CHECK CIRCUIT 8-GN11 (WH/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: Rear Electronic Module (REM) C420b. • Disconnect: Parking Aid Module C4014b . • Measure the resistance between the parking aid module C4014b-11, circuit 8-GN11 (WH/RD), harness side, and the REM C420b-4, circuit 8-AD15 (WH/BU), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR the circuit. TEST the system for normal operation.
B5 CHECK CIRCUIT 8-GN12 (WH/BU) FOR A SHORT TO GROUND	
• With the parking aid disable switch in the DISABLE position, measure the resistance between the parking aid module C4014b-9, circuit 8-GN12 (WH/BU), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B7 . **No** GO to B6 .
B6 CHECK THE PARKING AID DISABLE SWITCH FOR A SHORT TO GROUND	

• Disconnect: Parking Aid Disable Switch C9011. • Measure the resistance between the parking aid module C4014b-9, circuit 8-GN12 (WH/BU), harness side and ground.  A0061018 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new parking aid disable switch. REFER to Parking Aid Switch in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
B7 CHECK THE PARKING AID DISABLE SWITCH CIRCUITS FOR AN OPEN	
• While pressing the parking aid disable switch, measure the resistance between the parking aid module C4014b-9, circuit 8-GN12 (WH/BU), harness side and ground  A0061018 • **Is the resistance less than 5 ohms?**	**Yes** GO to B10 . **No** GO to B8 .
B8 CHECK CIRCUIT 8-GN12 (WH/BU) FOR AN OPEN	
• Disconnect: Parking Aid Disable Switch C9011. • Measure the resistance between the parking aid disable switch C9011-4, circuit 8-GN12 (WH/BU), harness side, and the parking aid module C4014b-9, circuit 8-GN12 (WH/BU), harness side.  A0061761 • **Is the resistance less than 5 ohms?**	**Yes** GO to B9 . **No** REPAIR the circuit. TEST the system for normal operation.
B9 CHECK CIRCUIT 31-GN12 (BK/OG) FOR AN OPEN	

• Measure the resistance between the parking aid disable switch C9011-3, circuit 31-GN12 (BK/OG), harness side and ground.  A0061028 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new parking aid disable switch. REFER to Parking Aid Switch in this section. **No** REPAIR the circuit. TEST the system for normal operation.
B10 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  • corrosion
  • pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Parking Aid Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: DTCs C1700, C1703 — Parking Aid Sensor Circuit Failure, B1299 — Power Supply Sensor Circuit Short to Ground

Normal Operation

The parking aid module supplies power to the parking aid ultrasonic sensors on circuit 7-GN1 (YE/RD). The parking aid module supplies ground to the parking aid ultrasonic sensors on circuit 9-GN1 (BN/RD). The parking aid module receives a signal from the parking aid sensors on circuits 8-GN19 (WH) and 8-GN20 (WH/RD).

Possible Causes

- circuit 7-GN1 (YE/RD) open or short to ground
- circuit 8-GN19 (WH) open or short to ground
- circuit 8-GN20 (WH/RD) open or short to ground
- circuit 9-GN1 (BN/RD) open
- parking aid sensor(s)
- parking aid module

PINPOINT TEST C: DTCs C1700, C1703 — PARKING AID SENSOR CIRCUIT FAILURE, B1299 — POWER SUPPLY SENSOR CIRCUIT SHORT TO GROUND

⚠ **CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take

C1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM BOTH THE CONTINUOUS AND ON-DEMAND PARKING AID MODULE SELF-TESTS

- Retrieve the recorded parking aid module DTCs from the continuous and on-demand self-tests.
- **Are any DTCs recorded?**

Yes
If multiple DTCs are recorded, GO to C2 .

For DTCs C1700 or C1703, GO to C3 .

For DTC B1299, GO to C4 .

All others, REFER to the Parking Aid Module Diagnostic Trouble Code (DTC) Index.

No
GO to Pinpoint Test B .

C2 CHECK THE BUMPER WIRING HARNESS

- Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion.
- **Is the bumper harness OK?**

Yes
GO to C3 .

No
REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK THE SENSOR CIRCUITRY FOR OPENS

- Ignition OFF.
- Disconnect: Suspect Parking Aid Sensor C4192 or C4193.
- Disconnect: Parking Aid Module C4014a.
- Measure the resistance between the parking aid module, harness side and the suspect parking aid sensor, harness side as follows:

Yes
GO to C4 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Rear Sensors

DTC	Sensor	Parking Aid Module Connector - Pin	Sensor Connector - Pin	Circuit
C1700	LH Ultrasonic	C4014a-13	C4192-3	7-GN1 (YE/RD) 7-GN20 (YE/RD)
C1700	LH Ultrasonic	C4014a-3	C4192-2	9-GN1 (BN/RD)

				9-GN20 (BN/RD)
C1700	LH Ultrasonic	C4014a-6	C4192-1	8-GN20 (WH/RD)
C1703	RH Ultrasonic	C4014a-13	C4193-3	7-GN1 (YE/RD) 7-GN19 (YE)
C1703	RH Ultrasonic	C4014a-3	C4193-2	9-GN1 (BN/RD) 9-GN19 (BN)
C1703	RH Ultrasonic	C4014a-7	4193-1	8-GN19 (WH)

- **Are the resistances less than 5 ohms?**

C4 CHECK THE SENSOR CIRCUITRY FOR SHORTS TO GROUND

- Measure the resistance between the suspect parking aid sensor harness side and ground as follows:

Rear Sensors

DTC	Sensor	Sensor Connector - Pin	Circuit
C1700 or B1299	LH Ultrasonic	C4192-3	7-GN20 (YE/RD)
C1700	LH Ultrasonic	C4192-2	9-GN20 (BN/RD)
C1700	LH Ultrasonic	C4192-1	8-GN20 (WH/RD)
C1703 or B1299	RH Ultrasonic	C4193-3	7-GN19 (YE)
C1703	RH Ultrasonic	C4193-2	9-GN19 (BN)
C1703	RH Ultrasonic	C4193-1	8-GN19 (WH)

- **Is the resistance greater than 10,000 ohms?**

Yes
If both of the parking aid ultrasonic sensors recorded DTCs, GO to C5 .

If one or more parking aid sensors recorded DTCs, INSTALL a new sensor(s) for the one in question. REFER to Parking Aid Sensor in this section. CLEAR the DTCs. REPEAT the self-test.

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK FOR CORRECT PARKING AID MODULE OPERATION

- Disconnect the parking aid module connector.
- Check for:

Yes
INSTALL a new parking aid module. REFER to Parking Aid

• corrosion • pushed-out pins • Connect the parking aid module connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTC C1984 — Radar Sensor Circuit Failure

Normal Operation

The parking aid module supplies power to the parking aid radar sensor on circuit 7-GN21 (YE/BU). The parking aid module supplies ground to the parking aid radar sensor on circuit 31S-GN21 (BK/OG). The parking aid module receives a signal from the parking aid radar sensor on circuit 8-GN21 (WH/BU).

Possible Causes

- circuit 7-GN21 (YE/BU) open or short to ground
- circuit 8-GN21 (WH/BU) open or short to ground
- circuit 31S-GN21 (BK/OG) open
- parking aid sensor
- parking aid module

PINPOINT TEST D: DTC C1984 — RADAR SENSOR CIRCUIT FAILURE

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
D1 CHECK THE BUMPER WIRING HARNESS	
• Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion. • **Is the bumper harness OK?**	**Yes** GO to D2 . **No** REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.
D2 CHECK THE SENSOR CIRCUITRY FOR OPENS	
• Ignition OFF. • Disconnect: Parking Aid Sensor C4191. • Disconnect: Parking Aid Module C4014a. • Measure the resistance between the parking aid module, harness side and the parking aid sensor, harness side as follows:	**Yes** GO to D3 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Parking Aid Module Connector - Pin	Sensor Connector - Pin	Circuit
C4014a-14	C4191-4	7-GN21 (YE/BU)
C4014a-4	C4191-3	31S-GN21 (BK/OG)
C4014a-16	C4191-2	8-GN21 (WH/BU)

- **Are the resistances less than 5 ohms?**

D3 CHECK THE SENSOR CIRCUITRY FOR SHORTS TO GROUND	
• Measure the resistance between the parking aid sensor harness side and ground as follows: **Sensor Connector - Pin / Circuit** C4191-4 — 7-GN21 (YE/BU) C4191-3 — 31S-GN21 (BK/OG) C4191-2 — 8-GN21 (WH/BU) • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D4 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  • corrosion
  • pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Parking Aid Module in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: DTC C1985 — Parking Aid Disable Switch Stuck Low

Normal Operation

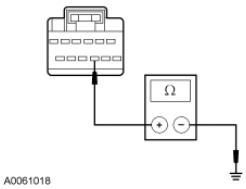
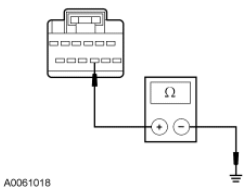
The parking aid system is enabled when the ignition switch is in the RUN position and REVERSE gear is selected. The system can be enabled/disabled through the parking aid disable switch. The parking aid module sends a reference voltage to the parking aid disable switch on circuit 8-GN12 (WH/BU). The parking aid module senses when the parking aid disable switch is closed to ground.

Possible Causes

- circuit 8-GN12 (WH/BU) short to ground
- parking aid module
- parking aid disable switch

PINPOINT TEST E: DTC C1985 — PARKING AID DISABLE SWITCH STUCK LOW

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
E1 CHECK CIRCUIT 8-GN12 (WH/BU) FOR A SHORT TO GROUND	
• Disconnect: Parking Aid Module C4014b. • Measure the resistance between the parking aid module C4014b-9, circuit 8-GN12 (WH/BU), harness side and ground.  A0061018 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E3 . **No** GO to E2 .
E2 CHECK THE PARKING AID DISABLE SWITCH FOR A SHORT TO GROUND	
• Disconnect: Parking Aid Disable Switch C9011. • Measure the resistance between the parking aid module C4014b-9, circuit 8-GN12 (WH/BU), harness side and ground.  A0061018 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new parking aid disable switch. REFER to Parking Aid Switch in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E3 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  • corrosion
  • pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Parking Aid Module in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: DTC C1627 — PRNDL Reverse Input Circuit Failure

Normal Operation

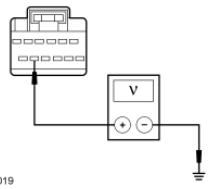
The parking aid system is enabled when the ignition switch is in the RUN position and REVERSE gear is selected. The system receives a reverse signal from the rear electronics module (REM) on circuit 8-GN11 (WH/RD).

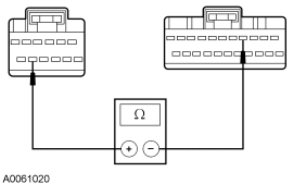
Possible Causes

- circuit 8-GN11 (WH/RD) open
- parking aid module
- REM

PINPOINT TEST F: DTC C1627 — PRNDL REVERSE INPUT CIRCUIT FAILURE

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
F1 CHECK CIRCUIT 8-GN11 (WH/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Parking Aid Module C4014b. • Ignition ON. • Select REVERSE. • Measure the voltage between the parking aid module C4014b-11, circuit 8-GN11 (WH/RD), harness side and ground.  A0061019 • **Is the voltage greater than 10 volts?**	**Yes** GO to F4 . **No** GO to F2 .
F2 CHECK CIRCUIT 8-GN11 (WH/RD) FOR AN OPEN	

• Ignition OFF. • Disconnect: REM C420b. • Measure the resistance between the parking aid module C4014b-11, circuit 8-GN11 (WH/RD), harness side, and the REM C420b-4, circuit 8-AD15 (WH/BU), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to F3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F3 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	REFER to Section 419-10 for continued diagnosis of the REM.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

F4 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  • corrosion
  • pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Parking Aid Module in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: DTC C1992 — Vehicle Speed Circuit Failure

Normal Operation

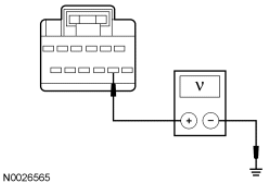
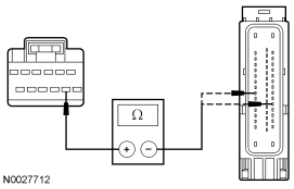
The parking aid system is enabled when the ignition switch is in the RUN position and REVERSE gear is selected. The system receives a vehicle speed signal from the anti-lock brake system (ABS) control module on circuit 8-GN14 (WH/BK).

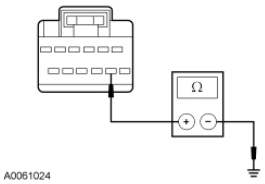
Possible Causes

- circuit 8-GN14 (WH/BK) open or short to ground
- parking aid module
- ABS control module

PINPOINT TEST G: DTC C1992 — VEHICLE SPEED CIRCUIT FAILURE

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

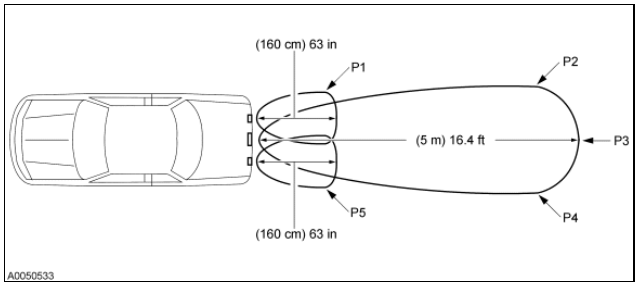
Test Step	Result / Action to Take
G1 CHECK CIRCUIT 8-GN14 (WH/BK) FOR VOLTAGE	
• Disconnect: Parking Aid Module C4014b. • Ignition ON. • Measure the voltage between the parking aid module C4014b-8, circuit 8-GN14 (WH/BK), harness side and ground.  N0026565 • **Is the voltage greater than 10 volts?**	**Yes** GO to G4 . **No** GO to G2 .
G2 CHECK CIRCUIT 8-GN14 (WH/BK) FOR AN OPEN	
• Disconnect: ABS C155. • Measure the resistance between the parking aid module C4014b-8, circuit 8-GN14 (WH/BK), harness side, and the ABS C155-39 (with stability assist) or C155-6 (without stability assist), circuit 8-GN14 (WH/BK), harness side.  N0027712 • **Is the resistance less than 5 ohms?**	**Yes** GO to G3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
G3 CHECK CIRCUIT 8-GN14 (WH/BK) FOR A SHORT TO GROUND	
• Measure the resistance between the parking aid module C4014b-8, circuit 8-GN14 (WH/BK), harness side and ground.	**Yes** REFER to Section 206-09 for continued ABS control module diagnosis. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 • **Is the resistance greater than 10,000 ohms?**	
G4 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect the parking aid module connector.
• Check for:
  • corrosion
  • pushed-out pins
• Connect the parking aid module connector and make sure it seats correctly.
• Operate the system and determine if the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Parking Aid Module in this section. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Azimuth System Check

Maximum Detectable Object Locations



1. **NOTE:** The object used in this system check can be fabricated from a 7.62 cm (3 in) diameter plastic pipe, 1 m (39 in) in length (available as PVC pipe or similar from a hardware or plumbing supply).

   NOTE: The following system check should be carried out with the vehicle on a level surface.

   NOTE: The parking aid system defaults to on when the ignition key is cycled from OFF to ON.

   Key in the ON position, engine OFF.

2. Set the parking brake.

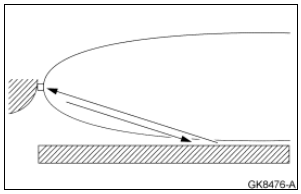
3. Place the transmission selector lever in REVERSE.

4. Verify that the parking aid system detects the specified object when placed within the 5 specified locations (P1, P2, P3, P4, P5). These zones are shown ideally and are not absolute. The pipe should be inside of the locations.

Elevation System Check

1. **NOTE:** The parking aid system must be checked to make sure that the system does not sense signals from ground reflections.

   Check the ground reflection verification and sensor coverage pattern.



2. The following system check should be carried out with the vehicle on a 3.0 m wide x 4.5 m long (10 ft x 15 ft) smooth concrete surface, free of all obstacles and noise from fan and pneumatic tools.

3. Key in the ON position, engine OFF.

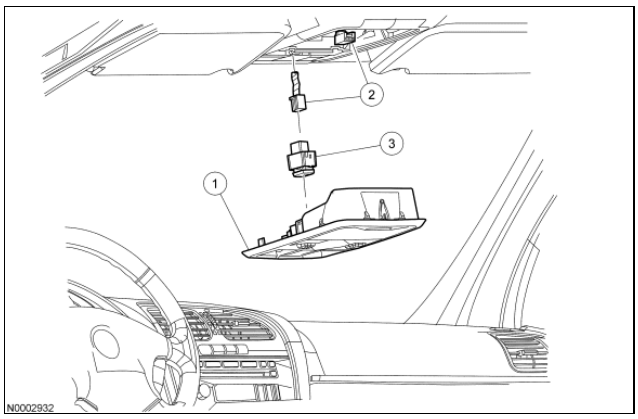
4. Set the parking brake.

5. Place the transmission selector lever in REVERSE.

6. **NOTE:** No audible alerts should be heard. If audible alerts are heard, make sure the bumper is correctly installed and is not tilted downward so that the sensor is pointing at the ground.

   Verify that no audible alerts are heard.

Parking Aid Switch



Item	Part Number	Description
1	54519A70	Overhead console
2	—	Overhead console electrical connectors (part of 14334)
3	15A860	Parking aid disable switch

Removal and Installation

1. **NOTE:** The overhead console is held in place by spring clips located on the panel.

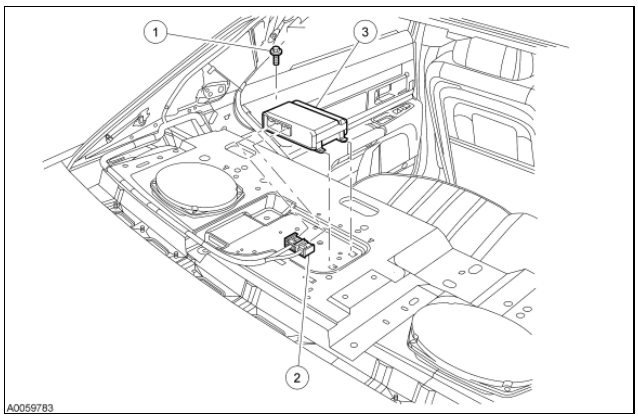
   Remove the overhead console.

   - Disconnect the electrical connectors.

2. Press the retaining tabs and remove the parking aid disable switch.

3. To install, reverse the removal procedure.

Parking Aid Module



Item	Part Number	Description
1	N610936	Parking aid module screw
2	—	Parking aid module electrical connector (part of 14A005)
3	15K866	Parking aid module

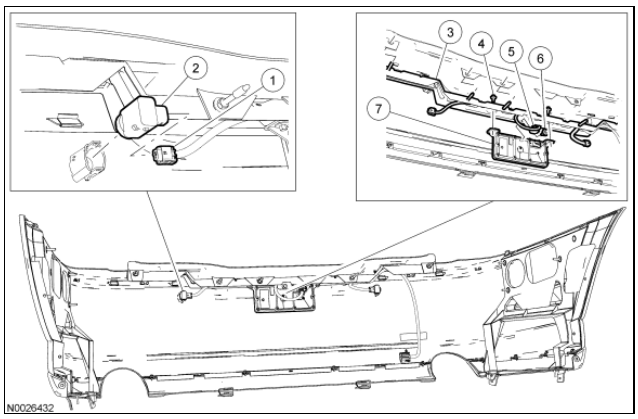
Removal and Installation

1. Remove the parcel shelf. For additional information, refer to Section 501-05 .

2. Remove the parking aid module and the screw.
   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

Parking Aid Sensor



Item	Part Number	Description
1	—	Parking aid ultrasonic sensor electrical connector
2	15K859	Parking aid ultrasonic sensors (2 required)
3	17D942	Rear bumper mounting bracket
4	N606676	Parking aid radar sensor bolts (2 required)
5	—	Parking aid radar sensor electrical connector
6	N606676	Parking aid radar sensor bolt
7	15K859	Parking aid radar sensor

Removal and Installation

All Sensors

1. Remove the rear bumper cover. For additional information, refer to Section 501-19 .

Ultrasonic Sensors

2. Disconnect the parking aid sensor electrical connectors.

3. Release the retaining tabs and remove the 2 parking aid ultrasonic sensors.

Radar Sensor

4. Disconnect the 2 parking aid ultrasonic sensors.

5. Remove the rear bumper mounting bracket.

6. Remove the 2 parking aid radar sensor bolts.

7. Disconnect the parking aid radar sensor.

8. Remove the parking aid radar sensor bolt and the radar parking aid sensor.

All Sensors

9. To install, reverse the removal procedure.

General Specifications

Item	Specification
Voltage	12 volts
Generator amps	70/134 amps (max) @ 1,800-6,000 generator rpm, approximately 525-2,000 engine rpm

Charging System

The charging system is a negative ground system controlled by the powertrain control module (PCM).

The generator (including an internal voltage regulator) is belt-driven by the engine accessory drive system. When the engine is started, the generator begins to generate alternating current (AC) which is internally converted to direct current (DC). This current is then supplied to the vehicle electrical system through the positive battery (B+) output terminal of the generator.

Battery

The battery is a 12-volt DC source connected in a negative ground system. The battery case is sealed with 2 vent holes to release gases. The battery has 3 major functions:

- engine cranking power source
- voltage stabilizer for the electrical system
- temporary power source when electrical loads exceed the generator output current

Charging System

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Special Tool(s)

ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
ST2173-A	SABRE Premium Battery And Electrical System Tester 010-00736 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Principles of Operation

The generator on this vehicle has a built-in voltage regulator set point. The generator determines optimal charging system voltage based on temperature. The generator has a communication line (GEN MON) indicating the generator operating duty cycle (including the generator load and error conditions) to the powertrain control module (PCM). The GEN MON circuit is a pulse width modulated (PWM) signal. The GEN MON communication line is also used for fault indication. If there is an error condition, the PCM sends a signal to the instrument cluster (using the standard corporate protocol [SCP] bus) to turn on the charging system warning indicator. The generator has an I terminal which is used for initially turning on the generator when the engine is started. The generator also has a dedicated battery sense terminal (A terminal), which is used to sense the battery voltage.

This is a System 3 charging system, which uses the GEN MON line to monitor the charging system through the PCM and includes a PCM-controlled I (ignition) circuit to the generator. System 3 charging systems are virtually identical in design and therefore, share the same diagnostics.

Circuit Description

Positive Battery Output (B+) Terminal Circuit 30-BA6 (RD)

Generator output voltage is supplied through the positive battery output (B+) terminal on the rear of the generator to the battery and the electrical system.

A Circuit 30-BA25 (RD)

This is the battery voltage sense or A circuit and is used to sense the battery voltage.

Circuit 8-BA25 (WH/RD)

The GEN MON circuit communicates the generator load and error conditions to the PCM. The PCM sends a signal to the instrument cluster using the SCP bus to turn on the charging system warning indicator if there is an error condition.

Circuit 10-BA25 (GY/RD)

NOTE: If the I circuit 10-BA25 (GY/RD) is open or shorted to ground, the generator does not function. If the engine speed exceeds 3,000 rpm, the generator self-excites, and begins to function normally (the battery light turns off and the generator operates normally) until the engine is turned off. This is a limp-home mode for customer safety.

This is the generator I (ignition) circuit. This circuit is used to turn the generator on when the engine is started. Once the generator is turned on, the generator only turns off when the engine is turned off.

Inspection & Verification

⚠ WARNING: Batteries contain sulfuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near batteries to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Batteries normally produce explosive gases. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

⚠ WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury, damage to the vehicle or battery. Lift with a battery carrier or with your hands on opposite corners. Failure to follow these instructions may result in personal injury.

NOTICE: **Do not make jumper connections except as directed. Incorrect connections may damage the voltage regulator test terminals, fuses, or fusible links.**

NOTICE: **Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.**

NOTE: All voltage measurements are referenced to the negative (-) battery post unless otherwise specified.

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Battery case, posts, hold-down clamp, cables and connections • Generator drive (serpentine) belt • Battery charge • Generator pulley • Generator	• Rear battery junction box (BJB) fuse 15 (5A) • Central junction box (CJB) fuse(s): ♦ 13 (5A) ♦ 20 (10A) • Circuitry • Charging system warning indicator • Cables • Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. Verify the battery condition. Refer to Section 414-01 .

5. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

6. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

7. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP, or ISO circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for PCM, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out the self-test diagnostics for the PCM.

8. If the DTCs retrieved are related to the concern, go to the Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
P1246	System Voltage Failure	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
All other DTCs	—	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Battery is Discharged or Battery Voltage is Low

Normal Operation

The generator output is supplied through the positive battery output (B+) terminal on the rear of the generator to the battery and electrical system. During normal operation, the charging system warning indicator should be off with the key in the ON position and with the engine running. The charging system warning indicator should be on with the key in the ON position with the engine off.

Possible Causes

- circuitry
- battery
- generator
- high key-off current drain(s)

PINPOINT TEST A: THE BATTERY IS DISCHARGED OR BATTERY VOLTAGE IS LOW

Test Step	Result / Action to Take
A1 CHECK THE BATTERY CONDITION	
• Carry out the Battery—Condition Test to determine if the battery can hold a charge and is OK for use. Refer to Section 414-01 . • **Does the battery pass the condition test?**	**Yes** GO to A2 . **No** INSTALL a new battery. REFER to Section 414-01 . TEST the system for normal operation.
A2 CHECK THE GENERATOR OUTPUT	
• Carry out the Generator On-Vehicle Tests—Load Test and No-Load Test. Refer to the Component Tests in this section. • **Does the generator pass the component tests?**	**Yes** GO to A3 . **No** GO to Pinpoint Test B to continue the diagnosis.
A3 CHECK FOR CURRENT DRAINS	
• Carry out the Battery — Drain Test. Refer to the Component Tests in this section. • **Are any circuits causing excessive current drains?**	**Yes** REPAIR the faulty circuit as necessary. TEST the system for normal operation. **No** GO to A4 .
A4 CHECK FOR CURRENT DRAINS THAT SHUT OFF WHEN THE BATTERY IS DISCONNECTED	
	Yes REPAIR the faulty component as

• Carry out the Battery — Electronic Drains Which Shut Off When the Battery Cable is Disconnected Test. Refer to the Component Tests in this section. • **Are any components causing excessive current drains?**	necessary. TEST the system for normal operation. **No** GO to Pinpoint Test B to diagnose the charging system.

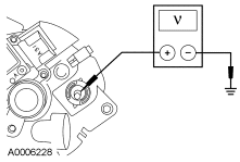
Pinpoint Test B: The Charging System Warning Indicator is On With the Engine Running (The Charging System Voltage Does Not Increase)

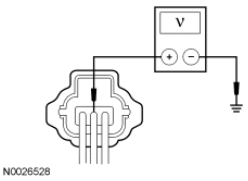
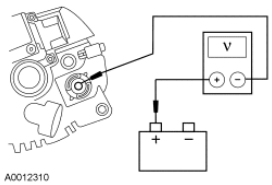
Normal Operation

With the engine running, the charging system warning indicator is off. The A circuit 30-BA25 (RD) carries 13-15 volts. The generator regulator compares the A circuit voltage to an internal set point voltage to determine when to operate. This duty cycle is output to the powertrain control module (PCM) on the GEN MON terminal 8-BA25 (WH/RD). In the case of failure, the GEN MON terminal is 0% (0 volts), or 100% duty cycle (12-14 volts). The I circuit 10-BA25 (GY/RD) carries 1-8 volts with the engine running and is only used to turn the generator on initially. The B+ output circuit 30-BA6 (RD) is the generator output supplied to the battery and the electrical system.

Possible Causes
- generator B+ output circuit 30-BA6 (RD) open or high resistance
- I circuit 10-BA25 (GY/RD) open or short to ground
- generator
- PCM

PINPOINT TEST B: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING (THE CHARGING SYSTEM VOLTAGE DOES NOT INCREASE)

Test Step	Result / Action to Take
B1 CHECK GENERATOR B+ OUTPUT CIRCUIT 30-BA6 (RD)	
• Ignition OFF. • Measure the voltage between the generator positive battery (B+) output terminal, circuit 30-BA6 (RD), component side and ground.  • **Is the voltage within 0.5 volt of B+ voltage ?**	**Yes** GO to B2 . **No** REPAIR the circuit. TEST the system for normal operation.
B2 CHECK I CIRCUIT 10-BA25 (GY/RD) FOR AN OPEN	
• Start the engine. • **NOTE:** Generator C102A must be connected for this test. • **NOTE:** If the I circuit 10-BA25 (GY/RD) is open or shorted to ground, the generator does not function. If the engine speed exceeds	**Yes** GO to B3 . **No** REPAIR the circuit. TEST

3,000 rpm, the generator self-excites, and begins to function normally (the battery light turns off and the generator operates normally) until the engine is turned off. This is a limp-home mode for customer safety. • With the engine running, measure the voltage between the generator C102A-2, I circuit 10-BA25 (GY/RD), harness side and ground.  N0026528 • **Is the voltage approximately 1 - 8 volts?**	the system for normal operation.
B3 CHECK FOR A VOLTAGE DROP IN B+ OUTPUT CIRCUIT 30-BA6 (RD)	
• With the engine running, turn on the headlamps and the rear defroster and position the blower motor to the HIGH position. • With the engine at 2,000 rpm, measure the voltage drop between the generator B+ output circuit 30-BA6 (RD), component side and the positive battery terminal.  A0012310 • **Is the voltage drop less than 0.5 volt?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** REPAIR the high resistance in the B+ output circuit 30-BA6 (RD). TEST the system for normal operation.

Pinpoint Test C: The Charging System Overcharges (Battery Voltage Is Greater Than 15.5 Volts)

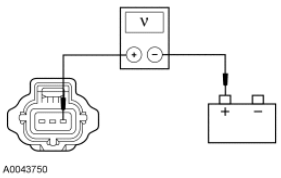
Normal Operation

The generator output is determined by the voltage of the A circuit 30-BA25 (RD). The A circuit voltage is compared to a set voltage internal to the regulator and the regulator controls the generator field current to maintain the correct generator output. The set voltage varies with temperature and is typically higher in cold temperatures and lower in warm temperatures.

Possible Causes

- A circuit 30-BA25 (RD) high resistance
- battery ground connections
- generator

PINPOINT TEST C: THE CHARGING SYSTEM OVERCHARGES (BATTERY VOLTAGE IS GREATER THAN 15.5 VOLTS)

Test Step	Result / Action to Take
C1 CHECK FOR A VOLTAGE DROP IN A CIRCUIT 30-BA25 (RD)	
• Ignition OFF. • Disconnect: Generator C102A. • Measure the voltage drop between the generator C102A-3, A circuit 30-BA25 (RD), harness side and the positive battery terminal.  • **Is the voltage drop less than 0.5 volt?**	**Yes** GO to C2 . **No** REPAIR the high resistance in the A circuit 30-BA25 (RD). TEST the system for normal operation.
C2 CHECK THE GENERATOR AND BATTERY GROUND CONNECTIONS	
• Check the ground connections between the generator and the engine, and between the battery and the engine. • **Are all ground connections clean and tight?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** REPAIR the ground connections as necessary. TEST the system for normal operation.

Pinpoint Test D: The Charging System Warning Indicator Is On With The Engine Running And The Battery Increases Voltage

Normal Operation

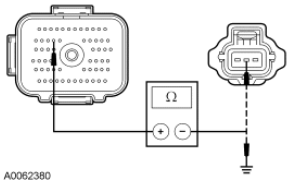
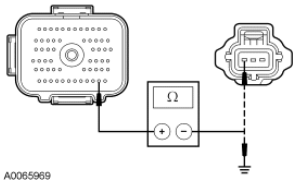
With the engine running, the charging system warning indicator is off. The A circuit 30-BA25 (RD) carries 13-15 volts. The generator regulator compares the A circuit voltage to an internal set point voltage to determine when to operate. This duty cycle is output to the powertrain control module (PCM) on the GEN MON terminal 8-BA25 (WH/RD). In the case of failure, the GEN MON terminal is 0% (0 volts), or 100% duty cycle (12-14 volts). The I circuit 10-BA25 (GY/RD) carries 1-8 volts with the engine running and is only used to turn the generator on initially. The B+ output circuit 30-BA6 (RD) is the generator output supplied to the battery and the electrical system.

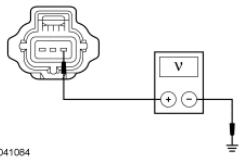
Possible Causes

- generator
- instrument cluster
- powertrain control module (PCM)
- I circuit 10-BA25 (GY/RD) open or short to ground
- GEN MON 8-BA25 (WH/RD) open or short to ground

- A circuit 30-BA25 (RD) open

PINPOINT TEST D: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING AND THE BATTERY INCREASES VOLTAGE

Test Step	Result / Action to Take
D1 CHECK I CIRCUIT 10-BA25 (GY/RD) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: Generator C102A. • Disconnect: PCM C175E. • Measure the resistance between the PCM C175E-19, circuit 10-BA25 (GY/RD), harness side and the generator C102A-2, circuit 10-BA25 (GY/RD), harness side; and between the PCM C175E-19, circuit 10-BA25 (GY/RD), harness side and ground.  A0062380 • **Is the resistance less than 5 ohms between the PCM and the generator, and greater than 10,000 ohms between the PCM and ground?**	**Yes** GO to D2 . **No** REPAIR the I circuit 10-BA25 (GY/RD). TEST the system for normal operation.
D2 CHECK CIRCUIT 8-BA25 (WH/RD) FOR AN OPEN OR SHORT TO GROUND	
• Measure the resistance between the PCM C175E-50, circuit 8-BA25 (WH/RD), harness side and the generator C102A-1, circuit 8-BA25 (WH/RD), harness side; and between the PCM C175E-50, circuit 8-BA25 (WH/RD), harness side and ground.  A0065969 • **Is the resistance less than 5 ohms between the PCM and the generator, and greater than 10,000 ohms between the PCM and ground?**	**Yes** GO to D3 . **No** REPAIR the circuit. TEST the system for normal operation.
D3 CHECK CIRCUIT 30-BA25 (RD) FOR AN OPEN	

• Measure the voltage between the generator C102A-3, circuit 30-BA25 (RD), harness side and ground.  A0041084 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

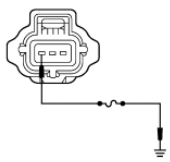
Pinpoint Test E: The Charging System Warning Indicator Is Off With The Ignition Switch In The RUN Position And The Engine Off

Normal Operation

The GEN MON circuit 8-BA25 (WH/RD) carries 0.1 volt with the key in the ON position (C102a connected) and the engine not running. This turns the charging system warning indicator on. This circuit is also used to turn the charging system warning indicator on if there is a fault in the charging system.

Possible Causes
- generator C102a unplugged
- generator
- instrument cluster
- powertrain control module (PCM)

PINPOINT TEST E: THE CHARGING SYSTEM WARNING INDICATOR IS OFF WITH THE IGNITION SWITCH IN THE RUN POSITION AND THE ENGINE OFF

Test Step	Result / Action to Take
E1 CHECK THE CHARGING SYSTEM WARNING INDICATOR	
• Ignition OFF. • Disconnect: Generator C102A. • With the engine off, connect a fused (15A) jumper wire between the generator C102A-1, GEN MON circuit 8-BA25 (WH/RD), harness side and ground.  A0041087 • Ignition ON. • **Is the charging system warning indicator illuminated?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** REFER to Section 413-01 for the diagnosis and testing of the instrument cluster.

Pinpoint Test F: The Charging System Warning Indicator Flickers or is Intermittent

Normal Operation

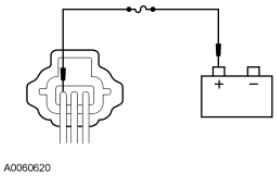
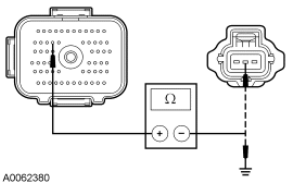
With the engine running, the charging system warning indicator should be off. The sense A circuit 30-BA25 (RD) to the generator field coil carries 13-15 volts. The I (ignition) circuit 10-BA25 (GY/RD) is used to turn on the voltage regulator. This circuit carries 0 volt (C102a connected) with the key in the ON position and the engine not running (1-8 volts with the engine running). The positive battery output (B+) circuit 30-BA6 (RD) is the generator output supplied to the battery and the electrical system.

Possible Causes

- rear battery junction box (BJB) fuse 15 (5A) connections
- generator
- generator connections
- instrument cluster

PINPOINT TEST F: THE CHARGING SYSTEM WARNING INDICATOR FLICKERS OR IS INTERMITTENT

Test Step	Result / Action to Take
F1 CHECK FOR LOOSE CONNECTIONS	
• Ignition OFF. • **NOTE:** If the I circuit 10-BA25 (GY/RD) is open or short to ground, the generator does not function. If the engine speed exceeds 3,000 rpm, the generator self-excites, and begins to function normally (the battery light turns off and the generator operates normally) until the engine is turned off. This is a limp-home mode for customer safety. • Check all generator, battery, rear BJB connections for looseness, corrosion, loose or bent terminals, or loose eyelets. • **Are all connections clean and tight?**	**Yes** If the charging system warning indicator flickers, INSTALL a new instrument cluster. REFER to Section 413-01 . If the charging system warning indicator is intermittent, GO to F2 . **No** REPAIR as necessary. TEST the system for normal operation.
F2 CHECK FOR LOOSE FUSE CONNECTIONS	
• Start the engine. • Check the rear BJB fuse 15 (5A) in A circuit 30-BA25 (RD) for looseness by wiggling the fuse and noting the charging system warning indicator operation. • **Does the charging system warning indicator flicker?**	**Yes** REPAIR the loose fuse connection(s) as necessary. TEST the system for normal operation. **No** GO to F3 .
F3 CHECK A CIRCUIT 30-BA25 (RD) FOR LOOSE CONNECTIONS	
• Ignition OFF. • Connect a fused (15A) jumper wire between the generator C102A-3, A circuit 30-BA25 (RD) (backprobed) and the positive battery terminal.	**Yes** GO to F4 . **No** REPAIR the loose connections in A circuit 30-BA25 (RD). TEST the

 A0060620 • Start the engine. • Note the charging system warning indicator operation. • **Does the charging system warning indicator illuminate?**	system for normal operation.
F4 CHECK I CIRCUIT 10-BA25 (GY/RD) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: PCM C175E. • Disconnect: Generator C102A. • Measure the resistance between the PCM C175E-19, circuit 10-BA25 (GY/RD), harness side and the generator C102A-2, circuit 10-BA25 (GY/RD), harness side; and between the PCM C175E-19, circuit 10-BA25 (GY/RD), harness side and ground.  A0062380 • **Is the resistance less than 5 ohms between the PCM and the generator, and greater than 10,000 ohms between the PCM and ground?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test G: The Generator is Noisy

Normal Operation

The generator is belt-driven by the engine accessory drive system.

Possible Causes
- accessory drive belt system
- generator mounting
- generator

PINPOINT TEST G: THE GENERATOR IS NOISY

Test Step	Result / Action to Take
G1 CHECK FOR ACCESSORY DRIVE NOISE	
• Ignition OFF.	**Yes** GO to G2 .

• Check the accessory drive belt for damage and correct installation. Check the accessory mounting brackets and the generator pulley for looseness or misalignment. Refer to Section 303-05 . • **Is the accessory drive OK?**	**No** REPAIR as necessary. REFER to Section 303-05 . TEST the system for normal operation.
G2 CHECK THE GENERATOR MOUNTING	
• Check the generator mounting for loose bolts or misalignment. Refer to Section 414-02 . • **Is the generator mounted correctly?**	**Yes** GO to G3 . **No** REPAIR as necessary. REFER to Section 414-02 . TEST the system for normal operation.
G3 CHECK THE GENERATOR FOR ELECTRICAL NOISE	
• Disconnect: Generator C102A. • Start the engine. • **NOTE:** Do not exceed 3,000 engine rpm or the generator may become electrically functional. • With the engine running, use a stethoscope or equivalent listening device to probe the generator. • **Is the noise still present?**	**Yes** GO to G4 . **No** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation.
G4 CHECK THE GENERATOR FOR MECHANICAL NOISE	
• With the engine running, use a stethoscope or equivalent listening device to probe the generator and the accessory drive area for unusual mechanical noise. • **Is the generator the source of the noise ?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** REFER to Section 303-00 to diagnose the source of the noise.

Pinpoint Test H: Radio Interference

Normal Operation

The generator radio suppression equipment reduces interference transmitted through the speakers by the vehicle electrical system.

Possible Causes

- generator
- in-vehicle entertainment system

PINPOINT TEST H: RADIO INTERFERENCE

Test Step	Result / Action to Take
H1 VERIFY THE GENERATOR IS THE SOURCE OF THE RADIO INTERFERENCE	

• Start the engine. • With the engine running, tune the audio unit to a station where the interference is present. • Ignition OFF. • Disconnect: Generator C102A. • Start the engine. • **NOTE:** Do not exceed 3,000 engine rpm or the generator may become electrically functional. • With the engine running, note any audio unit interference. • **Is the interference present with the generator disconnected?**	**Yes** REFER to Section 415-00 for the diagnosis and testing of the entertainment system. **No** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation.

Component Tests

Battery — Drain Test

⚠ WARNING: Do not attempt this test on a lead-acid battery that has recently been recharged. Explosive gases may cause personal injury. Failure to follow these instructions may result in personal injury.

NOTICE: **To prevent damage to the meter, do not crank the engine or operate accessories that draw more than 10A.**

NOTE: No production vehicle should have more than a 50 milliamp (mA) or 0.050 amp draw.

NOTE: Many modules draw 10 mA (0.010 amp) or more continuously.

NOTE: Use an in-line ammeter between the positive battery or negative post and its respective cable.

NOTE: Typically, a drain of approximately 1 amp is attributed to an engine compartment lamp, glove compartment lamp, or interior lamp staying on continually. Other component failures or wiring shorts may be located by selectively pulling fuses to pinpoint the location of the current drain. When the current drain is found, the meter reading falls to an acceptable level. If the drain is still not located after checking all of the fuses, it may be due to the generator.

NOTE: To accurately test the drain on a battery, use an in-line digital ammeter. Use of a test lamp or voltmeter is not an accurate method due to the number of electronic modules.

Check for current drains on the battery in excess of 50 mA (0.050 amp) with all of the electrical accessories off and the vehicle at rest. Current drains are tested with the following procedure:

1. Make sure the junction box/fuse panels are accessible without turning on the interior and underhood lights.

2. Drive the vehicle at least 5 minutes and over 48 km/h (30 mph) to turn on and activate the vehicle systems.

3. Allow the vehicle to sit with the key in the OFF position for at least 40 minutes to allow the modules to time out/power down.

4. Connect a fused (10A) jumper wire between the negative battery cable and the negative battery post to prevent the modules from resetting, and to catch capacitive drains.

5. Disconnect the negative battery cable from the battery post without breaking the connection of the jumper wire.

6. **NOTE:** It is very important that continuity is not broken between the battery and the negative battery cable when connecting the meter. If this happens, the entire procedure must be repeated.

   Connect the tester between the negative battery cable and the battery post. The meter must be capable of reading milliamps and should have a 10 amp capability.

7. **NOTE:** If the meter settings need to be switched or the test leads need to be moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

   Remove the jumper wire.

8. **NOTE:** Amperage draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference.

   NOTE: No production vehicle should have more than a 50 mA (0.050 amp) draw.

   Note the amperage draw.

9. If the draw is found to be excessive, remove the fuses from the CJB 1 at a time and note the current reading. Do not reinstall the fuses until you have finished testing. To properly isolate each of the circuits, all of the fuses may need to be removed and install 1 fuse, note the amperage draw, then remove the fuse and install the next fuse, until all of the circuits are checked. When the current level drops to an acceptable level after removing a fuse, the circuit containing the excessive draw has been located.

10. If the draw is still found to be excessive, remove the fuses from the BJB 1 at a time and note the current reading. Do not reinstall the fuses until you have finished testing. To properly isolate each of the circuits, all of the fuses may need to be removed and install 1 fuse, note the amperage draw, then remove the fuse and install the next fuse, until all of the circuits are checked. When the current level drops to an acceptable level after removing a fuse, the circuit containing the excessive draw has been located.

11. Check the wiring schematic in the wiring diagram for any circuits that run from the battery without passing through the BJB or CJB. Disconnect these circuits if the draw is still excessive.

Battery — Electronic Drains Which Shut Off When the Battery Cable is Disconnected Test

1. Repeat the steps of the battery drain testing.

2. Make sure all the doors are closed and all the accessories are off. Without starting the engine, turn the key to the ON position for a moment, and then OFF. Wait a few minutes for the illuminated entry lamps to turn off, if equipped.

3. Connect the ammeter and read the amperage draw.

The current reading (current drain) should be less than 50 mA (0.050 amp). If the current drain exceeds 50 mA (0.050 amp) after a few minutes, and if this drain did not show in previous tests, the drain is most likely caused by an inoperative electronic component. As in previous tests, remove the fuses from the BJB or CJB 1 at a time to locate the problem circuit.

Generator On-Vehicle Tests

NOTICE: **To prevent damage to the generator, do not make the jumper wire connections except as directed.**

NOTICE: **Do not allow any metal object to come in contact with the housing and the internal diode cooling fins with the key in the ON or OFF position. A short circuit may result and burn out the diodes.**

NOTE: Battery posts and cable clamps must be clean and tight for accurate meter indications.

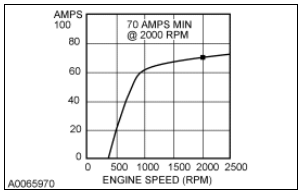
NOTE: Refer to the battery tester manual for complete directions for testing the charging system.

1. Turn off all of the lamps and electrical components.
2. Place the transmission in NEUTRAL and apply the parking brake.
3. Carry out the Load Test and No-Load Test according to the following component tests:

Generator On-Vehicle Tests — Load Test

1. Switch the tester to the ammeter function.
2. Connect the positive and negative leads of the tester to the corresponding battery terminals.
3. Connect the current probe to the generator B+ output terminal, circuit 30-BA6 (RD).
4. With the engine running at approximately 2,000 rpm, adjust the tester load bank to determine the output of the generator. The generator output should be at least 70 amps.

134 Amp Generator



5. With the engine running, turn the air conditioning (A/C) on, the blower motor on high speed, and the headlamps on high beam.
6. Increase the engine speed to approximately 2,000 rpm. The voltage should increase a minimum of 0.5 volt above the base voltage.
    - If the voltage does not increase as specified, carry out the Generator On-Vehicle Tests — No-Load Test in this section.
    - If the voltage increases as specified, the charging system is operating normally.

Generator On-Vehicle Tests — No-Load Test

1. Switch the tester to the voltmeter function.
2. Connect the voltmeter positive lead to the generator B+ terminal and the negative lead to ground.
3. Turn off all of the electrical accessories.
4. With the engine running at approximately 2,000 rpm, check the generator output voltage. The voltage should be between 13.2 and 15.5 volts. If not, refer back to the pinpoint test or GO to Symptom Chart

.

General Specifications

Item	Specification
Voltage	12 volts
Cold cranking amps (CCA) measured at -18°C (0°F)	650 CCA
Battery amps rating	72 amps/hr

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery cable terminals nuts/bolts	7	—	62
Battery hold-down clamp bolts	8	—	71
Battery ground cable bolt	12	9	—
Battery tray bolts	30	22	—
Body ground cable bolt	12	9	—
Bulkhead positive battery cable nut (engine compartment)	12	9	—
Generator B+ cable nut	8	—	71
Harness bracket screws	6	—	53
Positive battery cable nut (under instrument panel)	12	9	—
Rear battery junction box (BJB) cable assembly nut	12	9	—
Starter ground cable nut	25	18	—
Starter solenoid positive cable nut	12	9	—
Starter solenoid wire cable nut	6	—	53

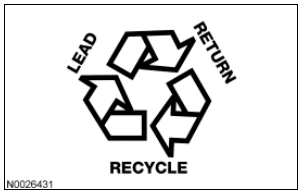
Battery and Cables

Vehicles are equipped with a 12-volt, maintenance-free battery.

The battery and cable system consists of the following components:

- Battery
- Battery cable assembly
- Battery tray

Ford Motor Company strongly recommends that lead-acid batteries be returned to an authorized recycling facility for disposal.



Battery

Special Tool(s)

ST2442-A	Micro 490 Digital Battery Analyzer 162-00004 or equivalent

Principles of Operation

Battery Eye Operation

The purpose of the battery eye is to indicate the state of charge of the battery in the assembly plant and while on the dealership lot. The battery eye can also indicate the state-of-charge when the vehicle is delivered to the dealership and during the pre-delivery inspection process. The battery eye is made up of a viewing plate, 2 balls and a small passage. The balls indicate the specific gravity of the electrolyte by floating higher or lower in the passageway. It is important to note that the battery eye checks the specific gravity on only a single battery cell.

The color of the battery eye indicates the approximate state of charge.

- Red usually indicates the battery state-of-charge is at 40% or less.
- Yellow indicates the battery state-of-charge is between 40% and 57%.
- Green indicates the battery state-of-charge is above 57%.
- No color/black can occur after the battery has been in service for several years and some of the plate material has coated the balls.
- A clear battery eye can occur if the battery case becomes damaged and the electrolyte has fallen below the plates.

NOTE: The battery eye may remain red for a period of time (up to several days), even after the battery is fully charged, because the acid is not yet fully mixed.

Do not replace a battery based solely on the indication of the battery eye. The battery eye color simply indicates the battery state-of-charge, not its condition. For example, a red or yellow battery eye usually indicates the battery is discharged, not defective. If the battery eye indicates the battery may be discharged, it is necessary to recharge the battery before testing its condition.

Charging a Battery

Batteries discharge while the vehicle is on the dealer lot or parked by the customer for an extended period of time due to normal parasitic key-off loads. Also, vehicles still in dealer inventory or in long-term storage may be driven short distances with heavy electrical loads. Over a period of time (30 days or more), this could result in vehicles having shallow or deeply discharged batteries.

- Deeply discharged — A battery that is drained over a prolonged period of time, such as an unsold vehicle or a vehicle in storage, to the point the battery is dead.
- Shallow discharge — A battery that is drained by leaving an accessory on for several hours or a few days and has a very low charge.

The vehicle's charging system is designed to supply the electrical power needed to maintain the battery near full charge during normal vehicle use. The charging system is not capable of bringing a deeply discharged battery back near full charge in a short amount of time such as allowing the vehicle to idle for 15 minutes to "recharge the battery." Discharged batteries should be charged using an external charger.

NOTE: Battery chargers have improved greatly with the addition of the new generation pulse chargers. These chargers pulse current into the battery, breaking down the sulfation layer on the battery plates and generally reduce charging times to less than an hour.

NOTE: Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm to approximately 5°C (41°F) before charging. This may require 4 to 8 hours at room temperature.

The following chart summarizes 2 recommended methods of charging.

Type of Battery Discharge	Pulse Charger	Standard Charger
Deeply discharged	Follow directions supplied with the pulse charger	2 to 8 hours and may take up to an hour to accept initial charge
Shallow discharge	45 minutes to an hour charge	2 hours (40A) on manual setting or medium automatic setting

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Battery • Battery mounting	• Battery cables • Battery posts

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, GO to Pinpoint Test A .

Pinpoint Tests

Pinpoint Test A: Battery Condition Test

Normal Operation

Battery condition is determined by measuring battery terminal voltage after a specific discharge current is applied for a specified time period.

Possible Causes

- Battery charge
- Battery

PINPOINT TEST A: BATTERY CONDITION TEST

Test Step	Result / Action to Take
A1 TEST THE BATTERY CONDITION	
NOTE: No battery with a red test-eye should be replaced. The red eye only means the battery is discharged, not necessarily defective. **NOTE:** Failure to fully charge the battery before retesting may cause false readings. • Verify the battery condition using the battery analyzer. • **Is the battery OK?**	**Yes** If the meter reads GOOD BATTERY, RETURN the battery to service. If the meter reads GOOD-RECHARGE, CHARGE the battery and RETURN it to service. If the meter reads CHARGE & RETEST, fully CHARGE and RETEST the battery. **No** If the meter reads REPLACE BATTERY, INSTALL a new battery. If the meter reads BAD CELL-REPLACE, INSTALL a new battery.

Battery Disconnect

⚠ WARNING: Batteries normally produce explosive gases. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

⚠ WARNING: To avoid accidental deployment and possible injury, the backup power supply must be depleted before repairing or installing any front or side air bag supplemental restraint system (SRS) components and before repairing, installing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches. Failure to follow these procedures may result in personal injury.

Refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped). Failure to follow these instructions may result in personal injury.

⚠ WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Keep out of the reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

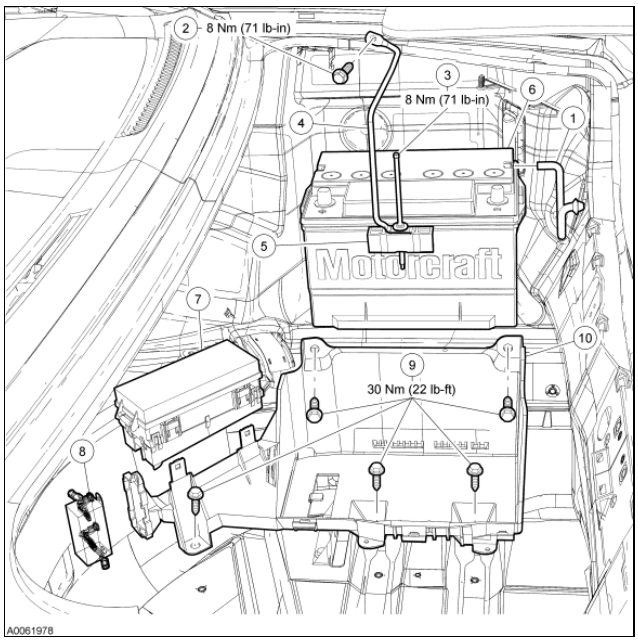
NOTE: Because the engine is electronically controlled by the powertrain control module (PCM), some control conditions are maintained by power from the battery. When the battery is disconnected or a new battery is installed, the engine must relearn its idle and fuel trim strategy for optimum driveability and performance. Allow the engine to idle for 1 minute. The relearning process automatically completes itself as the vehicle is driven. If the engine is not allowed to relearn its idle trim, the idle quality may be adversely affected until the idle trim is eventually relearned. Additionally, to account for customer driving habits and conditions, the automatic transmission must relearn its adaptive strategy. Optimal shifting resumes within a few hundred kilometers (miles) of operation. The clock and radio presets must be reset once the battery is reconnected. Check the front windows for one-touch up operation and the roof opening panel (if equipped) for one-touch close operation. If any have lost this functionality, they must be re-initialized. For window motor initialization, refer to Section 501-11 . For roof opening panel motor initialization, refer to Section 501-17 .

1. Disconnect the battery ground cable.
   - To connect, tighten to 7 Nm (62 lb-in).

2. Disconnect the positive battery cable.
   - To connect, tighten to 7 Nm (62 lb-in).

3. To connect, reverse the disconnect procedure.

Battery and Battery Tray — Exploded View



Item	Part Number	Description
1	10K650	Battery vent hose
2	—	Upper battery hold-down clamp bolt (part of 10756)
3	—	Lower battery hold-down clamp bolt (part of 10756)
4	—	Battery hold-down clamp (part of 10756)
5	10756	Battery hold-down clamp wedge
6	10655	Battery
7	14A067	Rear battery junction box (BJB)
8	—	Mega fuse holder (part of 14A005)
9	10764	Battery tray bolts (5 required)
10	10732	Battery tray

1. For additional information, refer to the procedures in this section.

Battery

Removal and Installation

⚠ WARNING: Batteries normally produce explosive gases. Therefore, do not allow flames, sparks, or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

⚠ WARNING: To avoid accidental deployment and possible injury, the backup power supply must be depleted before repairing or installing any front or side air bag supplemental restraint system (SRS) components and before repairing, installing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches. To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect any auxiliary batteries and power supplies (if equipped). Failure to follow these instructions may result in personal injury.

⚠ WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Keep out of the reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

NOTE: When the battery is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven to relearn its strategy.

1. Disconnect the battery. For additional information, refer to Battery Disconnect in this section.
2. Remove the vent hose from the battery.
3. Remove the upper battery hold-down clamp bolt.
   - To install, tighten to 8 Nm (71 lb-in).
4. Remove the lower battery hold-down clamp bolt.
   - To install, tighten to 8 Nm (71 lb-in).
5. Remove the battery hold-down clamp.
6. Remove the battery hold-down clamp wedge.
7. Remove the battery.
8. To install, reverse the removal procedure.

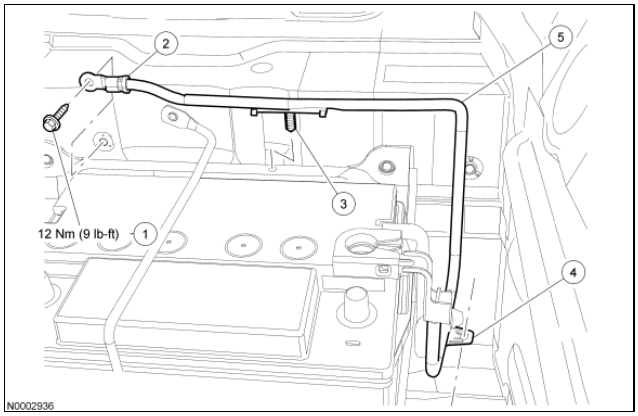
Battery Tray

Removal and Installation

1. Remove the battery. For additional information, refer to Battery in this section.
2. Remove the rear battery junction box (BJB) from the battery tray.
3. Remove the mega fuse holder from the battery tray.
4. Remove the 5 bolts and the battery tray.
   - To install, tighten to 30 Nm (22 lb-ft).
5. To install, reverse the removal procedure.

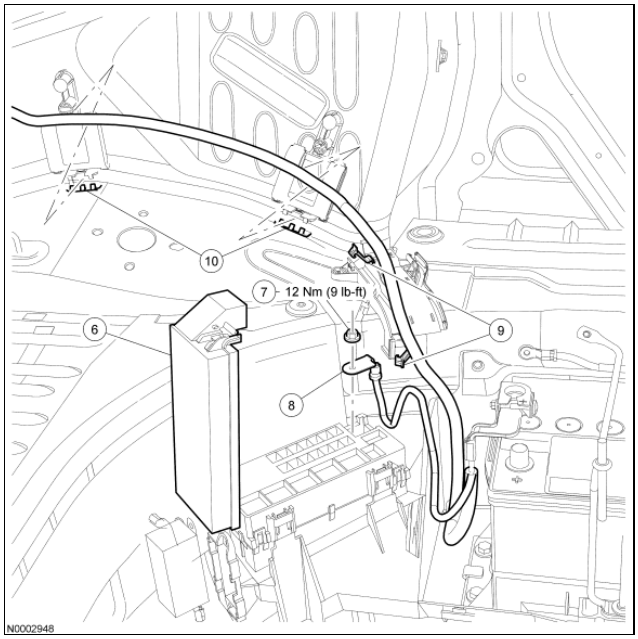
Battery Cables

Battery Ground Cable



Item	Part Number	Description
1	W705661	Battery ground cable bolt
2	—	Battery ground cable end (part of 14301)
3	—	Battery ground cable locator (part of 14301)
4	—	Battery ground cable locator (part of 14301)
5	14301	Battery ground cable

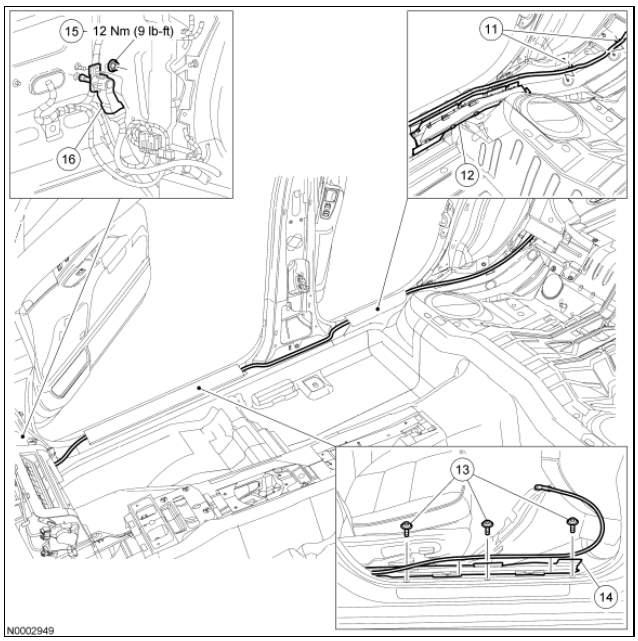
Positive Battery Cable Luggage Compartment Components



Item	Part Number	Description
6	—	Rear battery junction box (BJB) cover (part of 14A005)

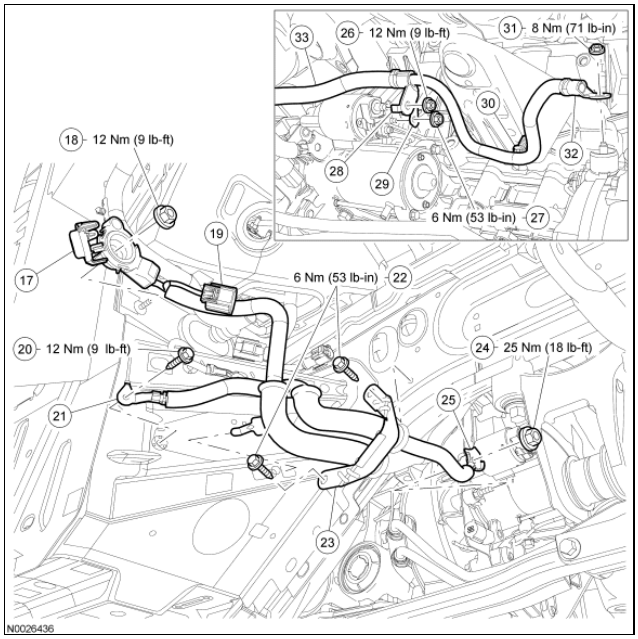
7	—	Rear BJB cable assembly nut
8	—	Rear BJB cable end (part of 14300)
9	—	Positive battery cable locators (2 required)
10	—	Positive battery cable locators (2 required)

Positive Battery Cable Passenger Compartment Components



Item	Part Number	Description
11	—	Positive battery cable locators (2 required) (part of 14A005)
12	—	Rear shield (part of 14A005)
13	W705321	Positive battery cable shield screws (3 required)
14	—	Front shield
15	W520002	Positive battery cable nut
16	14300	Rear positive battery cable assembly

Battery Cable Engine Compartment Components



Item	Part Number	Description
17	—	Bulkhead positive battery cable nut cover
18	W706275	Bulkhead positive battery cable nut
19	—	Electrical connector (part of 14305)
20	W705661	Body ground cable bolt
21	—	Body ground cable lead (part of 14305)
22	N606676	Harness bracket screws (2 required)
23	—	Harness bracket (part of 14305)
24	N805403	Starter ground cable nut
25	—	Starter ground cable end (part of 14305)
26	805403	Starter solenoid positive cable nut
27	405320	Starter solenoid wire cable nut
28	—	Starter solenoid positive cable end (part of 14305)
29	—	Starter solenoid wire cable end (part of 14305)
30	—	Generator harness locator (part of 14305)
31	805320	Generator B+ cable nut
32	—	Generator B+ cable end
33	14305	Engine compartment positive and ground cable assembly

Removal and Installation

All

1. Disconnect the battery. For additional information, refer to Battery Disconnect in this section.

Battery ground cable

2. Remove the battery ground cable bolt, 2 battery ground cable locators and the battery ground cable.
   - To install, tighten to 12 Nm (9 lb-ft).

Positive battery cable (rear)

3. Open the rear battery junction box (BJB) cover and remove the rear BJB cable assembly nut and cable end.
    - To install, tighten the nut to 12 Nm (9 lb-ft).
4. Release the positive battery cable from the 2 cable locators on the battery cable assembly conduit.
5. Release the positive battery cable from the 2 cable locators under the package tray.
6. Position the positive battery cable to ease removal from the luggage compartment.
7. From the passenger compartment, remove the rear seat(s) as necessary to obtain access to the positive battery cable. For additional information, refer to Section 501-10 .
8. Release the 2 positive battery cable locators from the rear seat area.
9. Remove the positive battery cable from the shield in the rear door opening area.
10. Remove the 3 screws from the positive battery cable shield in the front door opening area.
11. Remove the positive battery cable from the shield in the front door opening area.
12. From under the instrument panel, remove the positive battery cable nut.
    - To install, tighten to 12 Nm (9 lb-ft).
13. Remove the rear positive battery cable assembly.

Positive battery cable (front)

14. From the engine compartment, position aside the bulkhead positive battery cable nut cover and remove the bulkhead positive battery cable nut and cable end.
    - To install, tighten to 12 Nm (9 lb-ft).
15. Disconnect the electrical connector.
16. Remove the body ground cable bolt and position aside the body ground cable lead.
    - To install, tighten to 12 Nm (9 lb-ft).
17. Remove the 2 harness bracket screws.
    - To install, tighten to 6 Nm (53 lb-in).
18. Remove the harness bracket.
19. Remove the starter ground cable nut and cable end.
    - To install, tighten to 25 Nm (18 lb-ft).
20. Remove the starter solenoid positive cable nut and cable end.
    - To install, tighten to 12 Nm (9 lb-ft).
21. Remove the starter solenoid wire cable nut and cable end.
    - To install, tighten to 6 Nm (53 lb-in).
22. Remove the generator harness locator.
23. Remove the generator. For additional information, refer to Section 414-02 .

24. Position aside the generator B+ cover and remove the generator B+ cable nut and cable end.
    - To install, tighten to 8 Nm (71 lb-in).

25. Remove the engine compartment positive and ground cable assembly.

All

26. To install, reverse the removal procedure.

General Specifications

Item	Specification
Generator	
Rating	134 amps (max) @ 6,000 generator rpm, approx. 2,000 engine rpm
Generator pulley ratio	2.88:1
Voltage regulator type	Electronic internal with generator

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery cable terminals nuts/bolts	7	—	62
Generator bracket bolts	48	35	—
Generator B+ wire nut	8	—	71
Generator lower nut	45	33	—
Generator upper bolt	21	15	—
LH A/C suction line lower bracket bolt	10	—	89

Generator

The charging system consists of the following components:

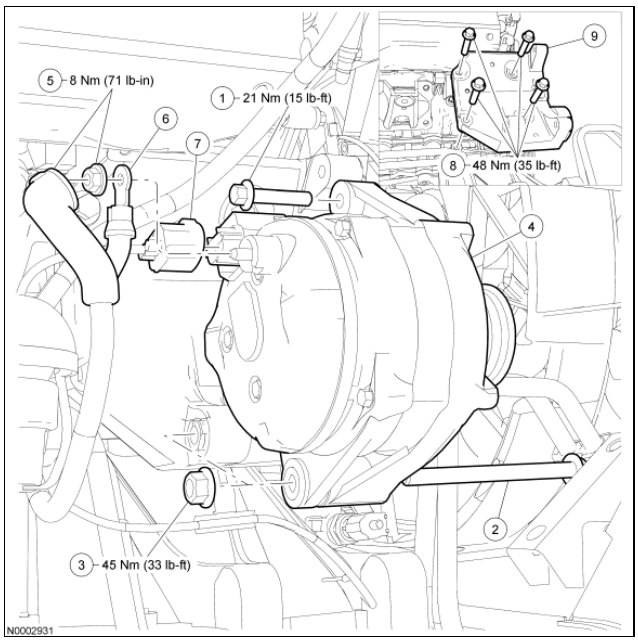
- Generator
- Integral voltage regulator

The generator is belt-driven by the engine accessory drive system. The generator has an internal voltage regulator that is not replaced separately. The generator and voltage regulator are repaired as an assembly.

Generator

Refer to Section 414-00 .

Generator — 3.9L



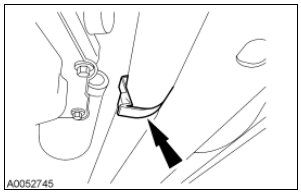
Item	Part Number	Description
1	W500311	Generator upper bolt
2	W700232	Generator lower bolt
3	W520414	Generator lower nut
4	10346	Generator
5	N805320	Generator B+ wire nut
6	14300	Generator B+ wire
7	—	Generator electrical connector
8	W500321	Generator bracket bolts (4 required)
9	10A313	Generator bracket

⚠ CAUTION: The generator must be supported by hand after removing the bolts and prior to disconnecting the electrical connector, or damage to the harness may result.

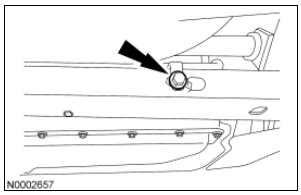
⚠ CAUTION: Care must be taken when removing the generator to prevent damage to the air conditioning (A/C) and cooling lines.

NOTE: The A/C suction line may need to be positioned rearward to ease removal of the generator.

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. Rotate the front end accessory drive (FEAD) belt tensioner counterclockwise and position the FEAD belt aside.
3. Remove the front valance panel.
4. Remove the air deflector.
5. Remove the A/C suction line clip from the radiator core support.



6. Remove the LH A/C suction line lower bracket bolt and position the bracket rearward.
    - To install, tighten to 10 Nm (89 lb-in).



7. Remove the generator upper bolt.
    - To install, tighten to 21 Nm (15 lb-ft).

8. Remove the generator lower nut and bolt.
    - To install, tighten to 45 Nm (33 lb-ft).

9. Disconnect the generator electrical connector.

10. Position the generator B+ wire protective cover aside and remove the generator B+ wire nut and cable end.
    - To install, tighten to 8 Nm (71 lb-in).

11. Remove the generator.

12. Remove the 4 generator bracket bolts.
    - To install, tighten to 48 Nm (35 lb-ft).

13. Remove the generator bracket.

14. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Antenna isolator module bolt	12	9	—
Audio unit amplifier screws	9	—	80
Navigation module and bracket assembly nuts	5	—	44
Subwoofer amplifier screws	9	—	80

Information and Entertainment System

Audio Unit

The audio system is enabled when the ignition switch is in the RUN or ACC position. The door speakers are powered directly by the audio unit. The navigation audio unit uses an audio unit amplifier and a subwoofer amplifier to power the door speakers and the subwoofer speakers, respectively. The DM100i unit directly powers the 4 door speakers. It is not equipped with a subwoofer or center imaging speaker. All audio units have steering wheel controls.

Antenna

The antenna system contains an antenna module that helps reduce interference when using the AM/FM bands. The antenna is a conductive trace type, integral to the rear window glass, and can be repaired separately. If the antenna cable needs to be replaced, a new cable needs to be routed and secured to the electrical harness.

Navigation

The navigation unit is responsible for generating the displays shown on the navigation audio unit screen by using video circuits (color generation and display synchronization), between the navigation unit and the navigation audio unit. When an on-screen menu key is pressed on the navigation audio unit screen, a signal is sent to the navigation unit through the controller area network (CAN) circuits. Refreshed data is then sent through the video circuits, and a new screen is displayed corresponding to which key was pressed. Diagnostic communication between the navigation unit and the navigation audio unit takes place over the CAN circuits.

Information and Entertainment System

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Principles of Operation

DM100i

When the audio unit is powered up, audio output signals are sent continuously to the speakers as a fluctuating AC voltage, thus producing sound from the speakers. The steering wheel controls are a multiplexed system that use different resistor values to produce different voltage levels on a single circuit. Each button that is pressed results in a unique voltage signal at the audio unit. This voltage signal is then interpreted by the audio unit as a distinct command. The audio unit is linked to the standard corporate protocol (SCP) communications network; therefore, trouble codes can be obtained with a diagnostic tool. The audio unit also has a self-diagnostic mode that can be entered by pressing preset buttons 3 and 6 simultaneously.

CDX6

When the audio unit is powered up, a wake-up signal is sent to the amplifiers. Audio output signals are then sent continuously to the subwoofer amplifier and audio unit amplifier. These signals are then amplified and sent to the speakers as a fluctuating AC voltage, thus producing sound from the speakers. The steering wheel controls are a multiplexed system that use different resistor values to produce different voltage levels on a single circuit. Each button that is pressed results in a unique voltage signal at the audio unit. This voltage signal is then interpreted by the audio unit as a distinct command. The audio unit is linked to the SCP communications network and; therefore, trouble codes can be obtained with a diagnostic tool. The audio unit also has a self-diagnostic mode that can be entered by pressing preset buttons 3 and 6 simultaneously.

Navigation

The navigation module controls the operation and the interface between the user, the vehicle subsystems, and the external components. The navigation module is on the standard corporate protocol (SCP) network and can be diagnosed with a diagnostic tool. Communication through the controller area network (CAN) uses data transmitted and received between the navigation module and the audio unit to control the video screen display

through the video interface circuits.

The vehicle navigation system guides the user to a pre-entered destination. A map digital versatile disc (DVD) stored in the navigation module sends route calculation data to the audio unit. The audio unit audibly and visually instructs the user of the maneuvers required to arrive at the destination entered.

A voice recognition system allows the user to interface with the system without using the touch screen. A microphone located in the rear view mirror provides a direct input to the navigation module.

The navigation module uses the global positioning system (GPS) antenna, vehicle speed, and other internal sensor information to accurately establish vehicle position. In order to calculate the initial vehicle position, the GPS antenna is used to track several available satellites simultaneously. The GPS antenna only receives data and does not communicate with the satellites. A gyroscope integral to the navigation module monitors the pitch and yaw of the vehicle created during cornering or turning. A hardwired vehicle speed input from the anti-lock brake system (ABS) module and a reverse input from the digital transmission range (TR) sensor through the SCP network are also used to detect vehicle speed and direction changes.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Audio unit • Navigation module • Antenna or antenna cable(s) • Antenna isolator module • Navigation system digital versatile disc (DVD) • Global positioning system (GPS) antenna • Speaker(s) • Subwoofer amplifier • Center imaging amplifier • Audio amplifier • Radio ignition interference capacitors, radio frequency interference suppression bond, and radio receiver hood bonding strap	• Central junction box (CJB) fuses: ♦ 2 (5A) (audio unit hot in START) ♦ 18 (20A) (audio unit hot at all times) ♦ 27 (10A) (audio unit hot in RUN/ACC) • Battery junction box (BJB) fuses: ♦ 5 (10A) (antenna module) ♦ 18 (20A) (CDX6) (audio amplifier)

	♦ 18 (30A) (Navigation) (audio amplifiers) • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** The audio unit must be on and in radio tuner mode (AM/FM) to enter the diagnostic tool tester diagnostics.

   If the cause is not visually evident, proceed to the Speaker Walk-Around Test and Audio Unit Self-Diagnostic Mode (CDX6 and DM100i), or connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:

   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), clear the continuous DTCs and carry out self-test diagnostics for the audio unit.

7. If the DTCs retrieved are related to the concern, go to the Audio Unit Diagnostic Trouble Code (DTC) Index or the Navigation System Module Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Speaker Walk-Around Test

NOTE: To enter the speaker walk-around test or the audio unit self-diagnostic mode, the audio unit must be on and in radio tuner mode (AM/FM).

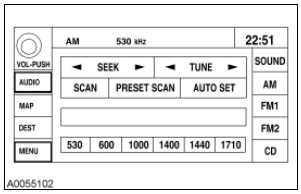
1. To enter the speaker walk-around test, simultaneously press and hold the audio unit preset buttons 3 and 6 (CDX6 or DM100i) or MAP and DEST (Navigation).

2. The speaker walk-around test interrupts sound from all speakers except for the one displayed on the audio unit. The audio unit allows sound to each speaker for about 1-2 seconds. Each speaker is tested and displayed on the audio unit in the following sequence: RF, LF, LR, RR, Subwoofer I, Subwoofer II. The center imaging speakers are tested last and the display is blank for about 1-2 seconds. These 2 are tested simultaneously.

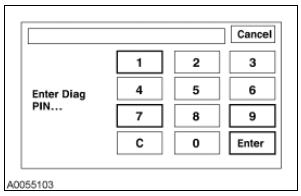
3. The speaker walk-around test automatically continues and tests for a speaker short. If a speaker short exists, SPKR SHORT is displayed.

Navigation Self-Diagnostics

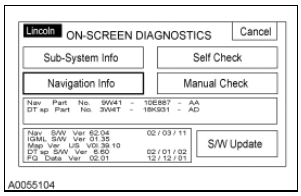
The navigation system provides internal self-diagnostics to assist with diagnosing vehicle concerns.



Press and hold the AUDIO and MENU buttons for 5 seconds.



Press 917 Enter.



- SELF CHECK provides internal self-test diagnostics. These diagnostic trouble codes (DTCs) are also accessible through the SCP network using a diagnostic tool.
- NAVIGATION INFO provides access to speed signal, gyro, reverse input, and GPS information.
- SUB-SYSTEM INFO provides the various component configurations.
- MANUAL CHECK provides access to several diagnostics input tests:
    - Voice Output verifies the audio signals from the navigation module and audio unit.
    - Hard Switch Test checks the various hardkey switches.
    - Microphone Test checks the strength of the voice signal.

Audio Unit Self-Diagnostic Mode — CDX6 and DM100i

NOTE: To enter the speaker walk-around test or the audio unit self-diagnostic mode, the audio unit must be on and in radio tuner mode (AM/FM). The audio unit self-diagnostic mode can only be entered while in the speaker walk-around test.

1. To enter the following audio unit self-diagnostic modes, press the desired preset button while in the speaker walk-around test. This aborts the speaker walk-around test and starts the selected test.

2. The audio unit self-diagnostic mode has 5 tests available:
    - Preset button 1 = Audio internal/external SELF TEST. If SELF FAIL is displayed, press TUNE > to scroll view the stored DTCs. Refer to the Audio Unit Diagnostic Trouble Code (DTC) Index in this section. If the system is OK, SELF PASS is displayed.
    - Preset button 2 = View/clear continuous diagnostic trouble codes (DTCs). NO DTCs is displayed if no DTCs are retrieved. If DTCs FOUND is displayed, press TUNE > button to view the DTCs retrieved. Refer to the Audio Unit Diagnostic Trouble Code (DTC) Index. To clear all DTCs press the EJECT button. DTCs CLEAR is displayed.
    - **NOTE:** Always document, clear, and carry out the audio unit on-demand self-test again.

Preset button 3 = SIGNAL TEST. This test measures the average strength at the current tuner setting.
- Preset button 4 = Software configuration level. This test queries each audio system controller for its software configuration level. SOFT LEVELS is displayed upon completion of the query. Press TUNE > to scroll view the software configuration version level.
- Preset button 5 = DISPLAY TEST. This test lights all the audio unit display segments for 5 seconds and then turns all the segments off. When the test is complete, DISPLAY TEST is displayed.
- Preset button 6 = CONFIG LEVELS. This shows the software configuration for the audio unit. Press TUNE > to scroll view the audio unit software configuration.

3. To exit the audio unit self-diagnostic mode, turn the ignition switch or the audio unit OFF.

4. If the concern remains and the fault is not detected, GO to Symptom Chart .

Audio Unit Self-Diagnostic Mode — Software Configuration Display

Controller	Description	Audio Unit Display Example
Main	Main Micro Software Version	MAIN ##.##.##
ADSP	ADSP Micro Software Version	ADSP ##.##.##
CDSP	CDSP Micro Software Version	CDSP ##.##.##
CDDJ	CDDJ Software Version	CDDJ ##.##.##
CD Changer	CDR Software Version	CD ##.##.##
RICP	RICP Software Version	RICP ##.##.##

Audio Unit Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	Audio Unit	DOCUMENT and CLEAR the DTCs. CARRY OUT the Audio Unit On-Demand Self-Test. If DTC B1342 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Audio Unit in this section. TEST the system for normal operation after the repair.
B2103	Antenna Not Connected	Audio Unit	GO to Pinpoint Test C .
B2401	Audio Tape Deck Mechanism Fault	Audio Unit	Not applicable for CDX6 or Navigation. For the DM100i, DOCUMENT and CLEAR the DTCs. CARRY OUT the Audio Unit On-Demand Self-Test. If DTC B2401 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Audio Unit in this section. TEST the system for normal operation after the repair.
B2404	Audio Steering Wheel Switch Circuit Fault	Audio Unit	GO to Pinpoint Test H .

B2405	Audio Single-Disc CD Player Thermal Shutdown Fault	Audio Unit	Not applicable for CDX6 or Navigation. For the DM100i, DOCUMENT and CLEAR the DTCs. CARRY OUT the Audio Unit On-Demand Self-Test. If DTC B2405 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Audio Unit in this section. TEST the system for normal operation after the repair.
B2406	Audio Single-Disc CD Player Internal Fault	Audio Unit	Not applicable for CDX6 or Navigation. For the DM100i, DOCUMENT and CLEAR the DTCs. CARRY OUT the Audio Unit On-Demand Self-Test. If DTC B2406 is retrieved again, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Audio Unit in this section. TEST the system for normal operation after the repair.
B2477	Module Configuration Fault	Audio Unit	REFER to Section 418-01 .
B2913	Subwoofer Not Connected	Audio Unit	GO to Pinpoint Test F .
U2008	Audio Phone is Not Responding	Audio Unit	Not applicable.
U2014	Audio Subwoofer Unit is Not Responding	Audio Unit	Not applicable for DM100i. For the CDX6, GO to Pinpoint Test F .
U2020	Center Image Amplifier is Not Responding	Audio Unit	Not applicable for DM100i. For the CDX6, GO to Pinpoint Test D .
All other DTCs	—	Audio Unit	REFER to Section 419-10 .

Navigation System Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	Navigation Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new navigation module. REFER to Navigation Module in this section. CLEAR the DTCs. REPEAT the self-test.
B2103	Antenna Not Connected	Navigation System Module	GO to Pinpoint Test C .
B2139	Data Mismatch	Navigation Module	CLEAR the DTCs. REPEAT the self-test. If DTC B2139 is retrieved again, REMOVE the navigation module. REFER to Navigation Module in this section. SEND it to an authorized repair facility. CLEAR the DTCs. REPEAT the self-test.
B2204			GO to Pinpoint Test K .

	GPS Antenna Connection Open or Short	Navigation Module	
B2208	Navigation to Head Unit Communication Error	Navigation Module	GO to Pinpoint Test R .
B2403	Audio CDDJ Internal Fault	Navigation System Module	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Audio Unit in this section. TEST the system for normal operation after the repair.
B2404	Audio Steering Wheel Switch Circuit Fault	Navigation System Module	GO to Pinpoint Test H .
B2477	Module Configuration Failure	Navigation Module	CHECK the navigation module configuration. REFER to Section 418-01 .
B2633	Driver — Front Microphone Circuit Failure	Navigation Module	GO to Pinpoint Test S .
B2858	Audio Unit Is Defective	Navigation System Module	REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Audio Unit in this section. TEST the system for normal operation after the repair.
B2913	Subwoofer Not Connected	Navigation System Module	GO to Pinpoint Test G .
C1192	Vehicle Speed Circuit Failure	Navigation Module	GO to Pinpoint Test L .
U1016	SCP Invalid Data (PCM)	Navigation Module	GO to Pinpoint Test T .
All other DTCs	—	Navigation System Module	REFER to Section 419-10 .

Symptom Chart

Symptom Chart — Audio System

Symptom Chart — Navigation

Pinpoint Tests

Pinpoint Test A: No Communication With The Audio Unit — CDX6 And DM100i Only

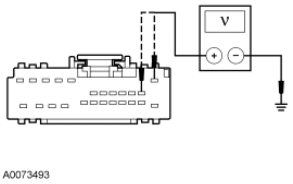
Normal Operation

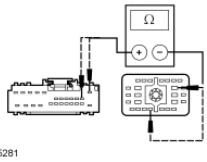
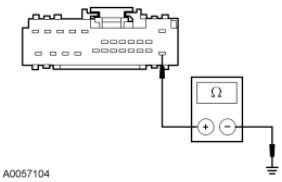
When the ignition switch is in the RUN position and the audio unit is turned on, communication is possible between the diagnostic tool and the audio unit through the standard corporate protocol (SCP) communications network. The audio unit receives power at all times through circuit 29-MD15 (OG/BK), and power in RUN/ACC through circuit 75-MD15. Ground for the audio unit is provided through circuit 31-MD15 (BK/GN) (DM100i) or 31-MD15A (BK/GN) (CDX6).

Possible Causes

- Fuse
- Circuit 29-MD15 (OG/BK) open
- Circuit 31-MD15 (BK/GN) open (DM100i)
- Circuit 31-MD15A (BK/GN) open (CDX6)
- Circuit 75-MD15 (YE/GN) open
- Audio unit
- Central junction box (CJB)

PINPOINT TEST A: NO COMMUNICATION WITH THE AUDIO UNIT — CDX6 AND DM100i ONLY

Test Step	Result / Action to Take
A1 CHECK CIRCUITS 29-MD15 (OG/BK) AND 75-MD15 (YE/GN) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Audio Unit C290b. • Ignition ON. • Measure the voltage between the audio unit C290b-1, circuit 29-MD15 (OG/BK), harness side and ground; and between the audio unit C290b-2, circuit 75-MD15 (YE/GN), harness side and ground.  A0073493 • **Are the voltages greater than 10 volts?**	**Yes** GO to A3 . **No** VERIFY the CJB fuse 18 (20A) or fuse 27 (10A) is OK. If OK, GO to A2 .
A2 CHECK CIRCUITS 29-MD15 (OG/BK) OR 75-MD15 (YE/GN) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: CJB C270a. • Measure the resistance between the audio unit C290b-1, circuit 29-MD15 (OG/BK), harness side and the CJB C270a-4, circuit 29-MD15 (OG/BK), harness side; or between the audio unit C290b-2, circuit 75-MD15 (YE/GN), harness side and the CJB C270a-18, circuit 75-MD15 (YE/GN), harness side.	**Yes** INSTALL a new CJB. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

 N0035281 • **Is the resistance less than 5 ohms?**	
A3 CHECK CIRCUIT 31-MD15 (BK/GN) OR 31-MD15A (BK/GN) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the audio unit C290b-13, circuit 31-MD15A (BK/GN)(CDX6) or circuit 31-MD15 (BK/GN)(DM100i), harness side and ground.  A0057104 • **Is the resistance less than 5 ohms?**	**Yes** REFER to Section 418-00 to continue diagnosis of the communications network. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Audio Unit is Inoperative/Does Not Operate Correctly

Normal Operation

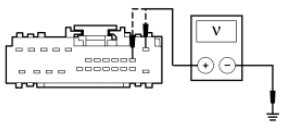
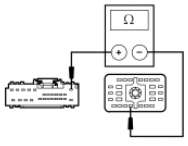
The audio unit receives voltage at all times through circuit 29-MD15 (OG/BK), and receives voltage through the accessory delay circuit 10-MD15 (GY/OG) (navigation) from the driver door module (DDM) when the accessory delay is active. Ground for the audio unit (navigation) is provided through circuits 31-MD15A (BK/GN) and 31-MD15B (BK/GN).

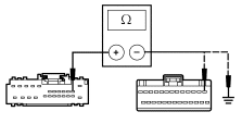
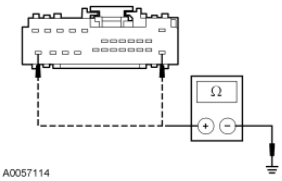
Possible Causes

- Fuse
- Circuit 29-MD15 (OG/BK) open
- Circuit 31-MD15A (BK/GN) open
- Circuit 31-MD15B (BK/GN) open
- Audio unit
- Central junction box (CJB)
- DDM

PINPOINT TEST B: THE AUDIO UNIT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
B1 CHECK FOR SOUND COMING FROM THE SPEAKERS	
• Carry out the speaker walk-around test. • Check for sound from the speakers.	**Yes** For navigation, GO to B2 .

• **Is sound coming from the speakers?**	For all others, REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Audio Unit in this section. TEST the system for normal operation after the repair. **No** For navigation, GO to Pinpoint Test E . For all others, GO to Pinpoint Test D .
B2 CHECK CIRCUITS 29-MD15 (OG/BK) AND 10-MD15 (GY/OG) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Audio Unit C2253a. • Ignition ON. • Measure the voltage between the audio unit C2253a-1, circuit 29-MD15 (OG/BK), harness side and ground; and between the audio unit C2253a-2, circuit 10-MD15 (GY/OG), harness side and ground.  A0065069 • **Are the voltages greater than 10 volts?**	**Yes** GO to B4 . **No** For circuit 29-MD15 (OG/BK), VERIFY the CJB fuse 18 (20A) is OK. If OK, GO to B3 . For circuit 10-MD15 (GY/OG), GO to B5 .
B3 CHECK CIRCUITS 29-MD15 (OG/BK) FOR AN OPEN	
• Ignition OFF. • Disconnect: CJB C270a. • Measure the resistance between the audio unit C2253a-1, circuit 29-MD15 (OG/BK), harness side and the CJB C270a-4, circuit 29-MD15 (OG/BK), harness side.  N0033858 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new CJB. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
B4 CHECK CIRCUITS 10-MD15 (GY/OG) FOR AN OPEN OR SHORT TO GROUND	

• Ignition OFF. • Disconnect: DDM C501d. • Measure the resistance between the audio unit C2253a-2, circuit 10-MD15 (GY/OG), harness side and the DDM C501d-1, circuit 10-AS43 (GY/VT); and between the audio unit C2253a-2, circuit 10-MD15 (GY/OG), harness side and ground.  N0033859 • **Is the resistance less than 5 ohms between the audio unit and the DDM, and greater than 10,000 ohms between the audio unit and ground**	**Yes** GO to B6 . **No** REPAIR the circuit TEST the system for normal operation.
B5 CHECK CIRCUITS 31-MD15A (BK/GN) AND 31-MD15B (BK/GN) FOR AN OPEN	
• Measure the resistance between the audio unit C2253a-13, circuit 31-MD15B (BK/GN), harness side and ground; and between the audio unit C2253a-24, circuit 31-MD15A (BK/GN), harness side and ground.  A0057114 • **Are the resistances less than 5 ohms?**	**Yes** SEND the audio unit to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** REPAIR the circuit in question. TEST the system for normal operation.
B6 CHECK FOR CORRECT DDM OPERATION	
• Disconnect all the DDM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the DDM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DDM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test C: Poor Reception

Normal Operation

The radio suppression equipment reduces engine ignition and electrical systems interference transmitted through the speakers.

Possible Causes

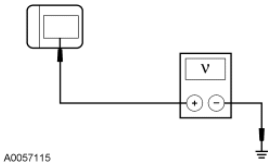
- Antenna
- Antenna connections
- Noise suppression equipment
- Antenna isolator module
- Audio unit

PINPOINT TEST C: POOR RECEPTION

NOTE: A break in the defroster grid will not cause an audio reception concern. It is normal for an audible popping sound to be heard when turning the defroster on or off. Advise the customer of the condition.

Test Step	Result / Action to Take
C1 CHECK THE AUDIO UNIT SIGNAL RECEPTION	
• Check the audio unit signal reception with the engine running and with the engine off. • **Is the audio unit signal reception noisy only with the engine running?**	**Yes** GO to C2 . **No** GO to C9 .
C2 CHECK THE SUPPRESSION EQUIPMENT	
• Check all required suppression equipment, the radio frequency interference suppression bond, and the hood bonding strap for security, cleanliness, and metal-to-metal contact. • **Are the contacts clean, secure, and in metal-to-metal contact?**	**Yes** GO to C3 . **No** CLEAN or SECURE the connections as necessary. TEST the system for normal operation.
C3 CHECK THE CAPACITOR MOUNTING AND CONNECTING CIRCUITS	
NOTE: The capacitor mounting points are used to complete the electrical circuit and must be mounted securely to clean surfaces. • Check the mounting and connecting circuits of the radio ignition interference capacitor(s) for security, cleanliness, and metal-to-metal contact.	**Yes** GO to C4 . **No** CLEAN or SECURE the connections as necessary. TEST the system for normal operation.

• **Are the contacts clean, secure, and in metal-to-metal contact?**	
C4 CHECK THE RADIO IGNITION INTERFERENCE CAPACITOR(S)	
• Check the operation of the radio ignition interference capacitor(s) by installing known good component(s). • Start the vehicle. • Check the operation of the audio unit. • **Is the reception OK?**	**Yes** REPAIR or INSTALL new components as necessary. TEST the system for normal operation. **No** GO to C5 .
C5 CHECK THE GENERATOR	
• With the vehicle running, check the generator by disconnecting the wiring harness from the voltage regulator. • Check the operation of the audio unit. • **Is the reception OK?**	**Yes** INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation. **No** GO to C6 .
C6 CHECK THE IGNITION CIRCUITS	
• Ignition OFF. • Check the ignition circuits for correct routing, grounding, and security of connections. • **Are the circuits OK?**	**Yes** GO to C7 . **No** REPAIR the circuit as necessary. TEST the system for normal operation.
C7 CHECK THE IGNITION SYSTEM	
• Check the ignition system. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is the ignition system OK?**	**Yes** GO to C8 . **No** REPAIR the ignition system. REFER to Section 303-07 . TEST the system for normal operation.
C8 SUBSTITUTE THE AUDIO UNIT	
• Ignition OFF. • Substitute a known good audio unit. Refer to Audio Unit in this section. • Start the vehicle. • Check the operation of the audio unit. • **Is the reception OK?**	**Yes** REMOVE the known good audio unit. SEND the original audio unit to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** INSTALL the original audio unit. USE a jumper cable to ground various parts of the vehicle to the frame (for example: engine, fenders, quarter panels, stone deflectors, air cleaner, body sheet metal). When the noise is eliminated, PROVIDE a permanent ground where necessary. TEST the system for normal operation.
C9 CHECK THE ANTENNA FOR DAMAGE	
• Ignition OFF. • Disconnect: Antenna Lead Terminal.	**Yes** GO to C10 . **No**

• Measure the resistance between the antenna cable lead terminal and the end of the antenna grid wire. • **Is the resistance less than 8 ohms?**	REPAIR the grid lines as necessary. REFER to Section 501-11 . CLEAR the DTCs. REPEAT the self-test.
C10 CHECK CIRCUIT 29S-MD7 (OG/BU) FOR VOLTAGE	
• Disconnect: Antenna Isolator Module C9021. • Ignition ON. • Measure the voltage between the antenna isolator module C9021-1, circuit 29S-MD7 (OG/BU), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to C11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C11 SUBSTITUTE THE ANTENNA ISOLATOR MODULE	
• Ignition OFF. • Substitute a known good antenna isolator module. • Ignition ON. • Check the operation of the audio unit. • **Is the reception OK?**	**Yes** INSTALL a new antenna isolator module. REFER to Antenna Isolator Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to C12 .
C12 SUBSTITUTE THE ANTENNA EXTENSION CABLE(S)	
• Ignition OFF. • Substitute a known good antenna cable(s) between the antenna isolator module and the audio unit. • Ignition ON. • Check the operation of the audio unit. • **Is the reception OK?**	**Yes** INSTALL a new antenna cable. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL the original antenna cable. REMOVE the audio unit and SEND it to an authorized audio system repair facility. REFER to Audio Unit in this section. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: Poor Quality/Distorted/No Sound From One Or More Speakers — Except Navigation Audio Unit

Normal Operation

When the key is placed in START, voltage is sent to the audio unit through circuit 50-MD15 (GY/OG). When the audio unit receives this signal, it mutes the speaker signals. After the key is removed from START, the audio unit directs audio signals to the door speakers through separate positive and negative circuits. Audio

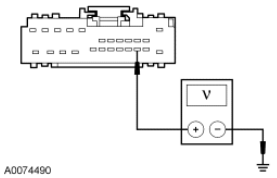
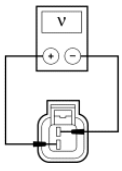
signals are also sent to the center imaging amplifier (if equipped) and the subwoofer amplifier (if equipped). The audio signals are then amplified and sent to the respective speakers. The audio unit provides internal circuit protection for shorts to ground, shorts to voltage, or shorts between any output circuits.

Possible Causes

- Fuse
- Circuit 1-MD12 (WH) open, short to ground or voltage
- Circuit 2-MD12 (GY) open, short to ground or voltage
- Circuit 7-MD12 (YE) open or short to ground
- Circuit 8-MD10 (WH/BK) open, short to ground or voltage
- Circuit 8-MD11 (WH/VT) open, short to ground or voltage
- Circuit 8-MD17 (WH/RD) open, short to ground or voltage
- Circuit 8-MD18 (WH) open, short to ground or voltage
- Circuit 8-MD30 (WH/BU) open, short to ground or voltage
- Circuit 8-MD31 (WH/GN) open, short to ground or voltage
- Circuit 10-MD10 (GY/BK) open, short to ground or voltage
- Circuit 10-MD11 (GY/WH) open, short to ground or voltage
- Circuit 10-MD17 (GY/RD) open, short to ground or voltage
- Circuit 10-MD18 (GY) open, short to ground or voltage
- Circuit 10-MD30 (GY/VT) open, short to ground or voltage
- Circuit 10-MD31 (GY/OG) open, short to ground or voltage
- Circuit 29-MD12 (OG/RD) open or short to ground
- Circuit 31-MD12 (BK/YE) open
- Circuit 50-MD15 (GY/OG) short to voltage
- Center imaging amplifier
- Speaker
- Audio unit

PINPOINT TEST D: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS — EXCEPT NAVIGATION AUDIO UNIT

Test Step	Result / Action to Take
D1 CHECK FOR SOUND	
• Ignition ON. • Carry out the speaker walk-around test. • **Do all speakers have poor quality/distorted/no sound?**	**Yes** If all speakers have no sound, GO to D2 . If all speakers have poor quality/distorted sound, REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** If the concern is with the subwoofer, GO to Pinpoint Test F .

	If the concern is with the center imaging speaker, GO to D6 . For all others, GO to D3 .
D2 CHECK CIRCUIT 50-MD15 (GY/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Audio Unit C290b. • Ignition ON. • Measure the voltage between the audio unit C290b-15, circuit 50-MD15 (GY/OG), harness side and ground.  A0074490 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** SEND the audio unit to an authorized audio system repair facility. TEST the system for normal operation after the repair.
D3 CHECK FOR AN AUDIO SIGNAL OUTPUT TO THE SUSPECT SPEAKER	
• Ignition OFF. • Disconnect: Suspect Speaker. • Ignition ON. • Operate the audio unit in radio tuner mode. • Measure the AC voltage between the suspect speaker pin 1 and pin 2, harness side as follows: **Suspect Speaker** / **Pin 1 Circuit** / **Pin 2 Circuit** LH front C523 / 8-MD10 (WH/BK) / 10-MD10 (GY/BK) RH front C612 / 8-MD17 (WH/RD) / 10-MD17 (GY/RD) LH rear C702 / 8-MD11 (WH/VT) / 10-MD11 (GY/WH) RH rear C802 / 8-MD18 (WH) / 10-MD18 (GY)  A0057116 • **Is there a fluctuating AC voltage?**	**Yes** INSTALL a new speaker. REFER to Door Speaker in this section. TEST the system for normal operation. **No** GO to D4 .
D4 CHECK THE AUDIO SIGNAL CIRCUITS FOR AN OPEN OR SHORT TO GROUND	

<table>
<tr>
<td>
• Ignition OFF.
• Disconnect: Audio Unit C290b.
• Measure the resistance between the suspect speaker, harness side and the audio unit, harness side; and between the suspect speaker, harness side and ground as follows:
<table>
<tr><th>Suspect Speaker</th><th>Speaker Connector-Pin</th><th>Audio Unit Connector-Pin</th><th>Circuit</th></tr>
<tr><td>LH front</td><td>C523-1</td><td>C290b-8</td><td>8-MD10 (WH/BK)</td></tr>
<tr><td>LH front</td><td>C523-2</td><td>C290b-21</td><td>10-MD10 (GY/BK)</td></tr>
<tr><td>RH front</td><td>C612-1</td><td>C290b-11</td><td>8-MD17 (WH/RD)</td></tr>
<tr><td>RH front</td><td>C612-2</td><td>C290b-12</td><td>10-MD17 (GY/RD)</td></tr>
<tr><td>LH rear</td><td>C702-1</td><td>C290b-9</td><td>8-MD11 (WH/VT)</td></tr>
<tr><td>LH rear</td><td>C702-2</td><td>C290b-22</td><td>10-MD11 (GY/WH)</td></tr>
<tr><td>RH rear</td><td>C802-1</td><td>C290b-10</td><td>8-MD18 (WH)</td></tr>
<tr><td>RH rear</td><td>C802-2</td><td>C290b-23</td><td>10-MD18 (GY)</td></tr>
</table>
• Are the resistances less than 5 ohms between the suspect speaker and the audio unit, and greater than 10,000 ohms between the suspect speaker and ground?
</td>
<td>Yes
GO to D5 .

No
REPAIR the circuit in question. TEST the system for normal operation.</td>
</tr>
<tr>
<td colspan="2">D5 CHECK THE AUDIO SIGNAL CIRCUITS FOR A SHORT TO VOLTAGE</td>
</tr>
<tr>
<td>
• Ignition ON.
• Measure the voltage between the suspect speaker, harness side and ground as follows:
<table>
<tr><th>Suspect Speaker</th><th>Connector-Pin/ Circuit</th><th>Connector-Pin/ Circuit</th></tr>
<tr><td>LH front</td><td>C523-1

8-MD10 (WH/BK)</td><td>C523-2

10-MD10 (GY/BK)</td></tr>
<tr><td>RH front</td><td>C612-1

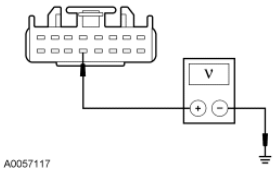
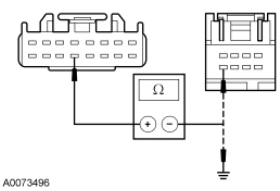
8-MD17 (WH/RD)</td><td>C612-2

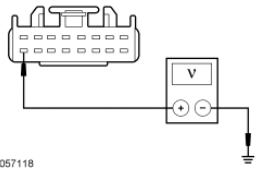
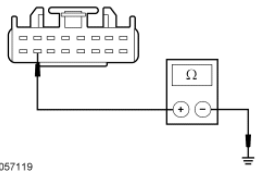
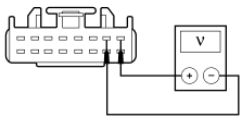
10-MD17 (GY/RD)</td></tr>
<tr><td>LH rear</td><td>C702-1</td><td>C702-2</td></tr>
</table>
</td>
<td>Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair.</td>
</tr>
</table>

	8-MD11 (WH/VT)	10-MD11 (GY/WH)
RH rear	C802-1 8-MD18 (WH)	C802-2 10-MD18 (GY)

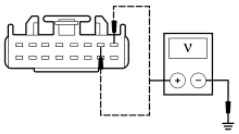
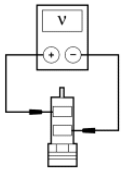
- **Is any voltage present?**

D6 CHECK THE CENTER IMAGING SPEAKER OPERATION	
• Ignition ON. • Operate the audio unit in radio tuner mode. • Check the operation of the center imaging speakers. • **Do both center imaging speakers have poor/distorted/no sound?**	**Yes** GO to D7 . **No** GO to D14 .
D7 CHECK CIRCUIT 7-MD12 (YE) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Center Imaging Amplifier C225. • Ignition ON. • Operate the audio unit in radio tuner mode. • Measure the voltage between the center imaging amplifier C225-13, circuit 7-MD12 (YE), harness side and ground.  A0057117 • **Is the voltage greater than 10 volts?**	**Yes** GO to D9 . **No** GO to D8 .
D8 CHECK CIRCUIT 7-MD12 (YE) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: Audio Unit C290d. • Measure the resistance between the center imaging amplifier C225-13, circuit 7-MD12 (YE), harness side and the audio unit C290d-8, circuit 7-MD12 (YE), harness side; and between the center imaging amplifier C225-13, circuit 7-MD12 (YE), harness side and ground.  A0073496 • **Is the resistance less than 5 ohms between the center imaging amplifier and the audio unit, and greater than 10,000 ohms between the center imaging amplifier and ground?**	**Yes** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D9 CHECK CIRCUIT 29-MD12 (OG/YE) FOR VOLTAGE	

• Measure the voltage between the center imaging amplifier C225-16, circuit 29-MD12 (OG/YE), harness side and ground.  A0057118 • **Is the voltage greater than 10 volts?**	**Yes** GO to D10 . **No** VERIFY the central junction box (CJB) fuse 18 (20A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D10 CHECK CIRCUIT 31-MD12 (BK/YE) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the center imaging amplifier C225-15, circuit 31-MD12 (BK/YE), harness side and ground.  A0057119 • **Is the resistance less than 5 ohms?**	**Yes** GO to D11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D11 CHECK FOR AN AUDIO SIGNAL OUTPUT TO THE CENTER IMAGING AMPLIFIER	
• Connect: Audio Unit C290d. • Ignition ON. • Operate the audio unit in radio tuner mode. • Measure the AC voltage between the center imaging amplifier C225-1, circuit 1-MD12 (WH), harness side and the center imaging amplifier C225-2, circuit 2-MD12 (GY), harness side.  A0065070 • **Is there a fluctuating AC voltage?**	**Yes** REMOVE the center imaging amplifier. REFER to Audio Amplifier in this section. SEND it to an authorized audio system repair facility. CLEAR the DTCs. REPEAT the self-test. **No** GO to D12 .
D12 CHECK CIRCUITS 1-MD12 (WH) AND 2-MD12 (GY) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: Audio Unit C290d. • Measure the resistance between the audio unit, harness side and the center imaging amplifier, harness side; and between the audio unit, harness side and ground as follows:	**Yes** GO to D13 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Audio Unit Connector-Pin	Center Imaging Amplifier Connector-Pin	Circuit
C290d-6	C225-2	2-MD12 (GY)
C290d-5	C225-1	1-MD12 (WH)

- **Are the resistances less than 5 ohms between the audio unit and the center imaging amplifier, and greater than 10,000 ohms between the audio unit and ground?**

D13 CHECK CIRCUITS 1-MD12 (WH) AND 2-MD12 (GY) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the center imaging amplifier C225-1, circuit 1-MD12 (WH), harness side and ground; and between the center imaging amplifier C225-2, circuit 2-MD12 (GY), harness side and ground:  N0033849 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized repair facility. TEST the system for normal operation after the repair.
D14 CHECK FOR AN AUDIO SIGNAL OUTPUT TO THE INOPERATIVE CENTER IMAGING SPEAKER	
• Ignition OFF. • Disconnect: Suspect Center Imaging Speaker. • Ignition ON. • Operate the audio unit in radio tuner mode. • Measure the AC voltage between the LH center imaging speaker C230-1, circuit 8-MD30 (WH/BU), harness side and the LH center imaging speaker C230-2, circuit 10-MD30 (GY/VT), harness side; or between the RH center imaging speaker C231-1, circuit 8-MD31 (WH/GN), harness side and the RH center imaging speaker C231-2, circuit 10-MD31 (GY/OG), harness side.  A0057124	**Yes** INSTALL a new center imaging speaker in question. TEST the system for normal operation. **No** GO to D15 .

• **Is there a fluctuating AC voltage?**	
D15 CHECK THE AUDIO SIGNAL CIRCUITS TO THE CENTER IMAGING SPEAKERS FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: Center Imaging Amplifier C225. • Measure the resistance between the center imaging amplifier, harness side and the suspect center imaging speaker, harness side; and between the center imaging amplifier, harness side and ground as follows: • **Is the resistance less than 5 ohms between the center imaging amplifier and the suspect center imaging speaker, and greater than 10,000 ohms between the center imaging amplifier and ground?**	**Yes** GO to D16 . **No** REPAIR the circuit in question. TEST the system for normal operation.
D16 CHECK THE AUDIO SIGNAL CIRCUIT TO THE CENTER IMAGING SPEAKER FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the center imaging amplifier, harness side and ground as follows: • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** REMOVE the center imaging amplifier. REFER to Audio Amplifier in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation.

Suspect Center Imaging Speaker	Center Imaging Amplifier Connector-Pin	Center Imaging Speaker Connector-Pin	Circuit
LH	C225-7	C230-1	8-MD30 (WH/BU)
LH	C225-8	C230-2	10-MD30 (GY/VT)
RH	C255-5	C231-1	8-MD31 (WH/GN)
RH	C225-6	C231-2	10-MD31 (GY/OG)

Suspect Circuit	Center Imaging Amplifier Connector-Pin
8-MD31 (WH/GN)	C255-5
10-MD31 (GY/OG)	C225-6
8-MD30 (WH/BU)	C225-7
10-MD30 (GY/VT)	C225-8

Pinpoint Test E: Poor Quality/Distorted/No Sound From One or More Speakers — Navigation Audio Unit Only

Normal Operation

When the key is placed in START, voltage is sent to the audio unit through circuit 50-MD15 (GY/OG). When the audio unit receives this signal, it mutes the speaker signals. After the key is removed from START, the audio unit directs audio signals to the audio amplifier through separate positive and negative circuits for each of the 4 audio channels: LH front, RH front, LH rear, and RH rear. The signals are then amplified by the audio amplifier and sent to the 4 door speakers. The audio unit provides internal circuit protection for shorts to ground, shorts to B+ battery, or shorts between any output circuits.

Possible Causes

- Fuse
- Circuit 8-MD10 (WH/BK) open, short to ground or voltage
- Circuit 8-MD10A (WH/BK) open, short to ground or voltage
- Circuit 8-MD11 (WH/VT) open, short to ground or voltage
- Circuit 8-MD11A (WH/VT) open, short to ground or voltage
- Circuit 8-MD17 (WH/RD) open, short to ground or voltage
- Circuit 8-MD17A (WH/RD) open, short to ground or voltage
- Circuit 8-MD18 (WH) open, short to ground or voltage
- Circuit 8-MD18A (WH) open, short to ground or voltage
- Circuit 10-MD10 (GY/BK) open, short to ground or voltage
- Circuit 10-MD10A (GY/BK) open, short to ground or voltage
- Circuit 10-MD11 (GY/WH) open, short to ground or voltage
- Circuit 10-MD11A (GY/WH) open, short to ground or voltage
- Circuit 10-MD17 (GY/RD) open, short to ground or voltage
- Circuit 10-MD17A (GY/RD) open, short to ground or voltage
- Circuit 10-MD18 (GY) open, short to ground or voltage
- Circuit 10-MD18A (GY) open, short to ground or voltage
- Circuit 30-MD27A (RD/WH) open
- Circuit 30-MD27B (RD/WH) open
- Circuit 30-MD27C (RD/WH) open
- Circuit 31-MD27A (BK/WH) open
- Circuit 31-MD27B (BK/WH) open
- Circuit 31-MD27C (BK/WH) open
- Speaker
- Audio unit
- Audio amplifier

PINPOINT TEST E: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS — NAVIGATION AUDIO UNIT ONLY

Test Step	Result / Action to Take
E1 CHECK FOR SOUND	
• Ignition ON. • Carry out the speaker walk-around test. • **Do all speakers have poor quality/distorted/no sound?**	**Yes** GO to E8 . **No** For the subwoofer, GO to Pinpoint Test G .

	For all others, GO to E2 .
E2 CHECK FOR AN AUDIO SIGNAL OUTPUT TO THE SUSPECT SPEAKER	
• Ignition OFF. • Disconnect: Suspect Speaker. • Ignition ON. • Operate the audio unit in radio tuner mode. • Measure the AC voltage between the suspect speaker pin 1 and pin 2, harness side as follows: **Suspect Speaker** / **Pin 1 Circuit** / **Pin 2 Circuit** LH front C523 / 8-MD10 (WH/BK) / 10-MD10 (GY/BK) RH front C612 / 8-MD17 (WH/RD) / 10-MD17 (GY/RD) LH rear C702 / 8-MD11 (WH/VT) / 10-MD11 (GY/WH) RH rear C802 / 8-MD18 (WH) / 10-MD18 (GY) • **Is there a fluctuating AC voltage?**	**Yes** INSTALL a new speaker. REFER to Door Speaker in this section. TEST the system for normal operation. **No** GO to E3 .
E3 CHECK THE AUDIO SIGNAL CIRCUITS FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: Audio Amplifier C4208b. • Measure the resistance between the audio amplifier, harness side and the suspect speaker, harness side; and between the audio amplifier, harness side and ground as follows: **Suspect Speaker** / **Audio Amplifier Connector-Pin** / **Suspect Speaker Connector-Pin** / **Circuit** LH front / C4208b-7 / C523-1 / 8-MD10 (WH/BK) LH front / C4208b-8 / C523-2 / 10-MD10 (GY/BK) RH front / C4208b-3 / C612-1 / 8-MD17 (WH/RD) RH front / C4208b-4 / C612-2 / 10-MD17 (GY/RD) LH rear / C4208b-5 / C702-1 / 8-MD11 (WH/VT) LH rear / C4208b-6 / C702-2 / 10-MD11 (GY/WH) RH rear / C4208b-1 / C802-1 / 8-MD18 (WH) RH rear / C4208b-2 / C802-2 /	**Yes** GO to E4 . **No** REPAIR the circuit in question. TEST the system for normal operation.

			10-MD18 (GY)

- **Is the resistance less than 5 ohms between the audio amplifier and the suspect speaker, and greater than 10,000 ohms between the audio amplifier and ground?**

E4 CHECK THE AUDIO SIGNAL CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH front	C523-1 8-MD10 (WH/BK)	C523-2 10-MD10 (GY/BK)
RH front	C612-1 8-MD17 (WH/RD)	C612-2 10-MD17 (GY/RD)
LH rear	C702-1 8-MD11 (WH/VT)	C702-2 10-MD11 (GY/WH)
RH rear	C802-1 8-MD18 (WH)	C802-2 10-MD18 (GY)

- **Is any voltage present?**

Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to E5 .

E5 CHECK THE AUDIO OUTPUT SIGNALS TO THE AUDIO AMPLIFIER

- Operate the audio unit in radio tuner mode.
- Measure the AC voltage between the audio amplifier signal circuit, harness side and the audio amplifier return circuit, harness side for the suspect speaker as follows:

Suspect Speaker	Audio Amplifier Connector-Pin/ Circuit	Audio Amplifier Connector-Pin/ Circuit
LH front	C4208a-8 8-MD10A (WH/BK)	C4208a-4 10-MD10A (GY/BK)
RH front	C4208a-6	C4208a-2

Yes
REMOVE the audio amplifier. REFER to Audio Amplifier in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair.

No
GO to E6 .

	8-MD17A (WH/RD)	10-MD17A (GY/RD)
LH rear	C4208a-7 8-MD11A (WH/VT)	C4208a-3 10-MD11A (GY/WH)
RH rear	C4208a-5 8-MD18A (WH)	C4208a-1 10-MD18A (GY)

- **Is there a fluctuating AC voltage?**

E6 CHECK THE AUDIO SIGNAL CIRCUITS TO THE AUDIO AMPLIFIER FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Disconnect: Audio Unit C2253d.
- Measure the resistance between the audio unit, harness side and the audio amplifier, harness side; and between the audio unit, harness side and ground as follows:

Suspect Speaker	Audio Unit Connector-Pin	Audio Amplifier Connector-Pin	Circuit
LH front	C2253d-1	C4208a-8	8-MD10A (WH/BK)
LH front	C2253d-10	C4208a-4	10-MD10A (GY/BK)
RH front	C2253d-2	C4208a-6	8-MD17A (WH/RD)
RH front	C2253d-11	C4208a-2	10-MD17A (GY/RD)
LH rear	C2253d-3	C4208a-7	8-MD11A (WH/VT)
LH rear	C2253d-12	C4208a-3	10-MD11A (GY/WH)
RH rear	C2253d-4	C4208a-5	8-MD18A (WH)
RH rear	C2253d-13	C4208a-1	10-MD18A (GY)

- **Is the resistance less than 5 ohms between the audio unit and the audio amplifier, and greater than 10,000 ohms between the audio unit and ground?**

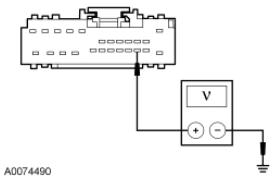
Yes
GO to E7 .

No
REPAIR the circuit in question. TEST the system for normal operation.

E7 CHECK THE AUDIO SIGNAL CIRCUITS TO THE AUDIO AMPLIFIER FOR A SHORT TO VOLTAGE

• Ignition ON. • Measure the voltage between the audio unit, harness side and ground as follows: • **Is the resistance less than 5 ohms between the audio unit and the audio amplifier, and greater than 10,000 ohms between the audio unit and ground?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair.

Suspect Speaker	Audio Unit Connector-Pin/ Circuit	Audio Unit Connector-Pin/ Circuit
LH front	C2253d-1 8-MD10A (WH/BK)	C2253d-10 10-MD10A (GY/BK)
RH front	C2253d-2 8-MD17A (WH/RD)	C2253d-11 10-MD17A (GY/RD)
LH rear	C2253d-3 8-MD11A (WH/VT)	C2253d-12 10-MD11A (GY/WH)
RH rear	C2253d-4 8-MD18A (WH)	C2253d-13 10-MD18A (GY)

E8 CHECK CIRCUIT 50-MD15 (GY/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Audio Unit C2253a. • Ignition ON. • Measure the voltage between the audio unit C2253a-15, circuit 50-MD15 (GY/OG), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to E9 .
E9 CHECK FOR VOLTAGE TO THE AUDIO AMPLIFIER	
• Ignition OFF. • Connect: Audio Unit C2253a. • Disconnect: Audio Amplifier C4208b. • Ignition ON. • Measure the voltage between the audio amplifier, harness side and ground as follows:	**Yes** GO to E10 . **No** VERIFY the battery junction box (BJB) fuse 18 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

Audio Amplifier Connector-Pin	Circuit
C4208a-14	30-MD27A (RD/WH)
C4208a-15	30-MD27B (RD/WH)
C4208a-15	30-MD27C (RD/WH)

- **Are the voltages greater than 10 volts?**

E10 CHECK THE AUDIO AMPLIFIER GROUND CIRCUITS FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the audio amplifier, harness side and ground as follows: **Audio Amplifier Connector-Pin** / **Circuit** C4208b-9 / 31-MD27A (BK/WH) C4208b-10 / 31-MD27B (BK/WH) C4208b-11 / 31-MD27C (BK/WH) • **Are the resistances less than 5 ohms?**	**Yes** REMOVE the audio amplifier. REFER to Audio Amplifier in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test F: The Subwoofer is Inoperative — CDX6 Only

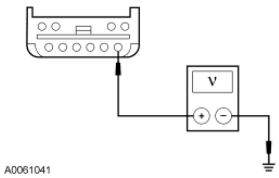
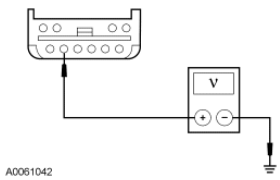
Normal Operation

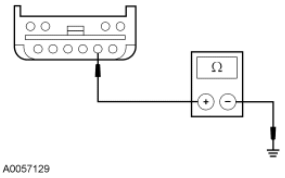
The subwoofer speakers are powered from a separate subwoofer amplifier. The clip detection circuit 7-MD19 (YE/RD) carries out 2 functions: to turn the subwoofer amplifier on, and to indicate to the audio unit when the subwoofer output distortion signal reaches a damaging level. The audio unit then reduces the audio output signal to the subwoofer amplifier.

Possible Causes

- Fuse
- Circuit 1-MD19 (WH/RD) open, short to ground or voltage
- Circuit 2-MD19 (GY/RD) open, short to ground or voltage
- Circuit 7-MD19 (YE/RD) open or short to ground
- Circuit 8-MD21 (WH/BU) open, short to ground or voltage
- Circuit 8-MD22 (WH/GN) open, short to ground or voltage
- Circuit 10-MD21 (GY/VT) open, short to ground or voltage
- Circuit 10-MD22 (GY/OG) open, short to ground or voltage
- Circuit 30-MD19A (RD/BU) open
- Circuit 31-MD19 (BK/BU) open
- Subwoofer amplifier
- Subwoofer speaker
- Audio unit

PINPOINT TEST F: THE SUBWOOFER IS INOPERATIVE — CDX6 ONLY

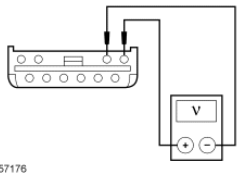
Test Step	Result / Action to Take
F1 CHECK THE SUBWOOFER OPERATION	
• Ignition ON. • Operate the audio unit in radio tuner mode. • Check the operation of the subwoofer speakers. • **Are both subwoofer speakers inoperative?**	**Yes** GO to F2 . **No** GO to F8 .
F2 CHECK CIRCUIT 7-MD19 (YE/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Subwoofer Amplifier C466a. • Ignition ON. • Operate the audio unit in radio tuner mode. • Measure the voltage between the subwoofer amplifier C466a-1, circuit 7-MD19 (YE/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to F3 . **No** GO to F11 .
F3 CHECK CIRCUIT 30-MD19A (RD/BU) FOR VOLTAGE	
• Measure the voltage between the subwoofer amplifier C466a-5, circuit 30-MD19A (RD/BU), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to F4 . **No** VERIFY the battery junction box (BJB) fuse 18 (20A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F4 CHECK CIRCUIT 31-MD19 (BK/BU) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the subwoofer amplifier C466a-2, circuit 31-MD19 (BK/BU), harness side and ground.	**Yes** GO to F5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.



- **Is the resistance less than 5 ohms?**

F5 CHECK FOR A SUBWOOFER AUDIO SIGNAL

- Ignition ON.
- Operate the audio unit in radio tuner mode.
- Measure the voltage between the subwoofer amplifier C466a-7, circuit 1-MD19 (WH/RD), harness side and the subwoofer amplifier C466a-8, circuit 2-MD19 (GY/RD), harness side.



- **Is there a fluctuating AC voltage?**

Yes
REMOVE the subwoofer amplifier. REFER to Subwoofer Amplifier in this section. SEND it to an authorized audio system repair facility. CLEAR the DTCs. REPEAT the self-test.

No
GO to F6 .

F6 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER AMPLIFIER FOR AN OPEN OR SHORT TO GROUND

- Disconnect: Audio Unit C290d.
- Measure the resistance between the subwoofer amplifier, harness side and the audio unit, harness side; and between the subwoofer amplifier, harness side and ground as follows:

Subwoofer Amplifier Connector-Pin	Audio Unit Connector-Pin	Circuit
C466a-7	C290d-1	1-MD19 (WH/RD)
C466a-8	C290d-2	2-MD19 (GY/RD)

- **Is the resistance less than 5 ohms between the subwoofer amplifier and the audio unit, and greater than 10,000 ohms between the subwoofer amplifier and ground?**

Yes
GO to F7 .

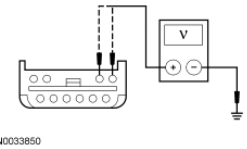
No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F7 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER AMPLIFIER FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure the voltage between the subwoofer amplifier C466a-7, circuit 1-MD19 (WH/RD), harness side and ground; and between the subwoofer amplifier C466a-8, circuit 2-MD19 (GY/RD), harness side and ground.

Yes
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

No
REMOVE the

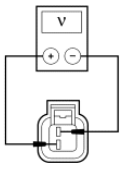


- **Is any voltage present?**

subwoofer amplifier. REFER to Subwoofer Amplifier in this section. SEND it to an authorized audio system repair facility. CLEAR the DTCs. REPEAT the self-test.

F8 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER SPEAKER

- Ignition OFF.
- Disconnect: Suspect Subwoofer Speaker.
- Ignition ON.
- Measure the AC voltage between the RH subwoofer speaker C4069-1, circuit 8-MD21 (WH/BU), harness side and the RH subwoofer speaker C4069-2, circuit 10-MD21 (GY/VT), harness side; or between the LH subwoofer speaker C4068-1, circuit 8-MD22 (WH/GN), harness side and the LH subwoofer speaker C4068-2, circuit 10-MD22 (GY/OG), harness side.



- **Is there a fluctuating AC voltage?**

Yes
INSTALL a new subwoofer speaker. REFER to Subwoofer Speaker in this section. TEST the system for normal operation.

No
GO to F9 .

F9 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER SPEAKER FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Disconnect: Subwoofer Amplifier C466b.
- Measure the resistance between the subwoofer amplifier, harness side and the suspect subwoofer speaker, harness side; and between the subwoofer amplifier, harness side and ground as follows:

Suspect Subwoofer Speaker	Subwoofer Amplifier Connector-Pin	Subwoofer Speaker Connector-Pin	Circuit
LH subwoofer	C466b-3	C4068-1	8-MD22 (WH/GN)
LH subwoofer	C466b-4	C4068-2	10-MD22 (GY/OG)
RH subwoofer	C466b-1	C4069-1	8-MD21 (WH/BU)
RH subwoofer	C466b-2	C4069-2	10-MD21

Yes
GO to F10 .

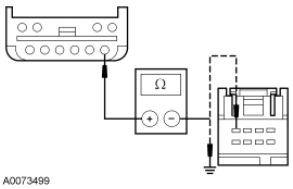
No
REPAIR the circuit in question. TEST the system for normal operation.

			(GY/VT)	

- **Is the resistance less than 5 ohms between the subwoofer amplifier and the speaker, and greater than 10,000 ohms between the subwoofer amplifier and ground?**

F10 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER SPEAKER FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the subwoofer amplifier, harness side and ground as follows: • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** REMOVE the subwoofer amplifier. REFER to Subwoofer Amplifier in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation.

Suspect Subwoofer Speaker	Subwoofer Speaker Connector-Pin/ Circuit	Subwoofer Speaker Connector-Pin/ Circuit
LH subwoofer	C466b-3 8-MD22 (WH/GN)	C466b-4 10-MD22 (GY/OG)
RH subwoofer	C466b-1 8-MD21 (WH/BU)	C466b-2 10-MD21 (GY/VT)

F11 CHECK CIRCUIT 7-MD19 (YE/RD) FOR AN OPEN OR SHORT TO GROUND	
• Disconnect: Audio Unit C290d. • Measure the resistance between the subwoofer amplifier C466a-1, circuit 7-MD19 (YE/RD), harness side and the audio unit C290d-4, circuit 7-MD19 (YE/RD), harness side; and between the subwoofer amplifier C466a-1, circuit 7-MD19 (YE/RD), harness side and ground.  A0073499 • **Is the resistance less than 5 ohms between the subwoofer amplifier and the audio unit, and greater than 10,000 ohms between the audio unit and ground?**	**Yes** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Subwoofer is Inoperative — Navigation Only

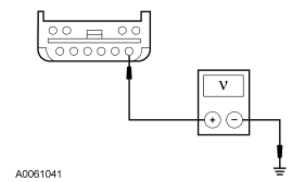
Normal Operation

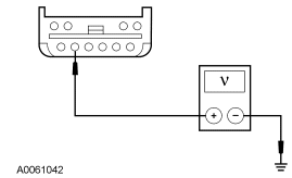
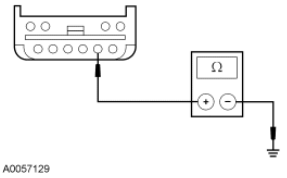
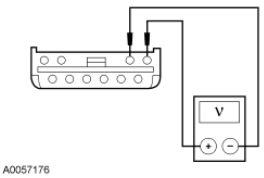
The subwoofer speakers are powered from a separate subwoofer amplifier. The clip detection circuit 7-MD19 (YE/RD) carries out 2 functions: to turn the subwoofer amplifier on, and to indicate to the audio unit when the subwoofer output distortion signal reaches a damaging level. The audio unit then reduces the audio output signal to the subwoofer amplifier.

Possible Causes

- Fuse
- Circuit 1-MD19 (WH/RD) open, short to ground or voltage
- Circuit 2-MD19 (GY/RD) open, short to ground or voltage
- Circuit 7-MD19 (YE/RD) open or short to ground
- Circuit 8-MD21 (WH/BU) open, short to ground or voltage
- Circuit 8-MD22 (WH/GN) open, short to ground or voltage
- Circuit 10-MD21 (GY/VT) open, short to ground or voltage
- Circuit 10-MD22 (GY/OG) open, short to ground or voltage
- Circuit 30-MD19A (RD/BU) open
- Circuit 31-MD19 (BK/BU) open
- Subwoofer amplifier
- Subwoofer speaker
- Audio unit

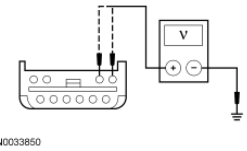
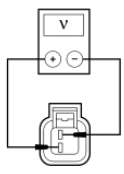
PINPOINT TEST G: THE SUBWOOFER IS INOPERATIVE — NAVIGATION ONLY

Test Step	Result / Action to Take
G1 CHECK THE SUBWOOFER OPERATION	
• Ignition ON. • Operate the audio unit in radio tuner mode. • Check the operation of the subwoofer speakers. • **Are both subwoofer speakers inoperative?**	**Yes** GO to G2 . **No** GO to G8 .
G2 CHECK CIRCUIT 7-MD19 (YE/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Subwoofer Amplifier C466a. • Ignition ON. • Operate the audio unit in radio tuner mode. • Measure the voltage between the subwoofer amplifier C466a-1, circuit 7-MD19 (YE/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to G3 . **No** GO to G11 .
G3 CHECK CIRCUIT 30-MD19A (RD/BU) FOR VOLTAGE	

• Measure the voltage between the subwoofer amplifier C466a-5, circuit 30-MD19A (RD/BU), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to G4 . **No** VERIFY the battery junction box (BJB) fuse 18 (20A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
G4 CHECK CIRCUIT 31-MD19 (BK/BU) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the subwoofer amplifier C466a-2, circuit 31-MD19 (BK/BU), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to G5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
G5 CHECK FOR A SUBWOOFER AUDIO SIGNAL	
• Ignition ON. • Operate the audio unit in radio tuner mode. • Measure the voltage between the subwoofer amplifier C466a-7, circuit 1-MD19 (WH/RD), harness side and the subwoofer amplifier C466a-8, circuit 2-MD19 (GY/RD), harness side.  • **Is there a fluctuating AC voltage?**	**Yes** REMOVE the subwoofer amplifier. REFER to Subwoofer Amplifier in this section. SEND it to an authorized audio system repair facility. CLEAR the DTCs. REPEAT the self-test. **No** GO to G6 .
G6 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER AMPLIFIER FOR AN OPEN OR SHORT TO GROUND	
• Disconnect: Audio Unit C2253d. • Measure the resistance between the subwoofer amplifier, harness side and the audio unit, harness side; and between the subwoofer amplifier, harness side and ground as follows:	**Yes** GO to G7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Subwoofer Amplifier Connector-Pin	Audio Unit Connector-Pin	Circuit
C466a-7	C2253d-7	1-MD19 (WH/RD)
C466a-8	C2253d-16	2-MD19 (GY/RD)

- **Is the resistance less than 5 ohms between the subwoofer amplifier and the audio unit, and greater than 10,000 ohms between the subwoofer amplifier and ground?**

G7 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER AMPLIFIER FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the subwoofer amplifier C466a-7, circuit 1-MD19 (WH/RD), harness side and ground; and between the subwoofer amplifier C466a-8, circuit 2-MD19 (GY/RD), harness side and ground:  N0033850 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** REMOVE the subwoofer amplifier. REFER to Subwoofer Amplifier in this section. SEND it to an authorized audio system repair facility. CLEAR the DTCs. REPEAT the self-test.
G8 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER SPEAKER	
• Ignition OFF. • Disconnect: Suspect Subwoofer Speaker. • Ignition ON. • Measure the AC voltage between the RH subwoofer speaker C4069-1, circuit 8-MD21 (WH/BU), harness side and the RH subwoofer speaker C4069-2, circuit 10-MD21 (GY/VT), harness side; or between the LH subwoofer speaker C4068-1, circuit 8-MD22 (WH/GN), harness side and the LH subwoofer speaker C4068-2, circuit 10-MD22 (GY/OG), harness side.  A0057116 • **Is there a fluctuating AC voltage?**	**Yes** INSTALL a new subwoofer speaker. REFER to Subwoofer Speaker in this section. TEST the system for normal operation. **No** GO to G9 .
G9 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER SPEAKER FOR AN OPEN OR SHORT TO GROUND	

<table>
<tr><td>
• Ignition OFF.
• Disconnect: Subwoofer Amplifier C466b.
• Measure the resistance between the subwoofer amplifier, harness side and the suspect subwoofer speaker, harness side; and between the subwoofer amplifier, harness side and ground as follows:
<table>
<tr><th>Suspect Subwoofer Speaker</th><th>Subwoofer Amplifier Connector-Pin</th><th>Subwoofer Speaker Connector-Pin</th><th>Circuit</th></tr>
<tr><td>LH subwoofer</td><td>C466b-3</td><td>C4068-1</td><td>8-MD22 (WH/GN)</td></tr>
<tr><td>LH subwoofer</td><td>C466b-4</td><td>C4068-2</td><td>10-MD22 (GY/OG)</td></tr>
<tr><td>RH subwoofer</td><td>C466b-1</td><td>C4069-1</td><td>8-MD21 (WH/BU)</td></tr>
<tr><td>RH subwoofer</td><td>C466b-2</td><td>C4069-2</td><td>10-MD21 (GY/VT)</td></tr>
</table>
• Is the resistance less than 5 ohms between the subwoofer amplifier and the speaker, and greater than 10,000 ohms between the subwoofer amplifier and ground?
</td><td>
Yes
GO to G10 .

No
REPAIR the circuit in question. TEST the system for normal operation.
</td></tr>
<tr><td>G10 CHECK THE AUDIO SIGNAL CIRCUITS TO THE SUBWOOFER SPEAKER FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>
• Ignition ON.
• Measure the voltage between the subwoofer amplifier, harness side and ground as follows:
<table>
<tr><th>Suspect Subwoofer Speaker</th><th>Subwoofer Speaker Connector-Pin/ Circuit</th><th>Subwoofer Speaker Connector-Pin/ Circuit</th></tr>
<tr><td>LH subwoofer</td><td>C466b-3

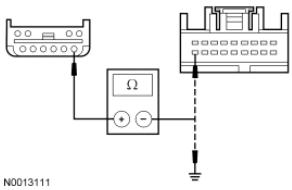
8-MD22 (WH/GN)</td><td>C466b-4

10-MD22 (GY/OG)</td></tr>
<tr><td>RH subwoofer</td><td>C466b-1

8-MD21 (WH/BU)</td><td>C466b-2

10-MD21 (GY/VT)</td></tr>
</table>
• Is any voltage present?
</td><td>
Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
REMOVE the subwoofer amplifier. REFER to Subwoofer Amplifier in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation.
</td></tr>
<tr><td>G11 CHECK CIRCUIT 7-MD19 (YE/RD) FOR AN OPEN OR SHORT TO GROUND</td><td></td></tr>
</table>

• Disconnect: Audio Unit C2253d. • Measure the resistance between the subwoofer amplifier C466a-1, circuit 7-MD19 (YE/RD), harness side and the audio unit C2253d-18, circuit 7-MD19 (YE/RD), harness side; and between the subwoofer amplifier C466a-1, circuit 7-MD19 (YE/RD), harness side and ground.  N0013111 • **Is the resistance less than 5 ohms between the subwoofer amplifier and the audio unit, and greater than 10,000 ohms between the audio unit and ground?**	**Yes** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: The Auxiliary Audio Control Is Inoperative/Does Not Operate Correctly — Steering Wheel Controls

Normal Operation

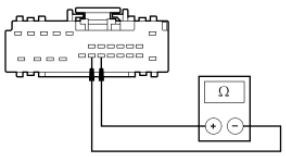
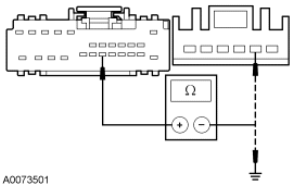
The steering wheel controls consist of a specific resistor value for each button function creating a voltage divider. When a button is pressed, a specific voltage is sent to the audio unit. The audio unit uses this voltage to determine which input function has been selected. Circuit 8-MD26 (WH/BK) is the reference voltage circuit between the steering wheel controls and the audio unit.

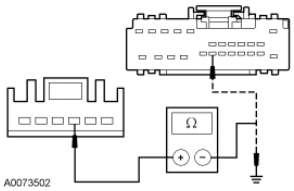
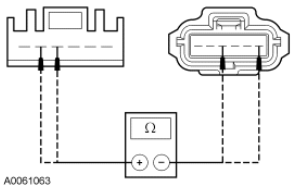
Possible Causes

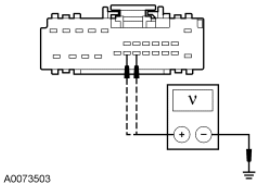
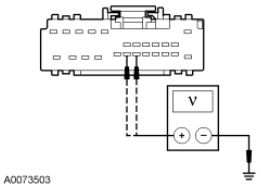
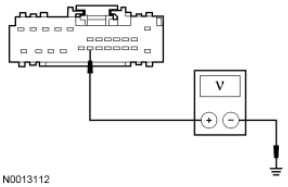
- Circuit 8-MD26 (WH/BK) open or short to ground
- Circuit 31S-MD26 (BK/RD) open
- Steering wheel controls
- Audio unit
- Clockspring
- Powertrain control module (PCM)
- Horn switch harness

PINPOINT TEST H: THE AUXILIARY AUDIO CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY — STEERING WHEEL CONTROLS

Test Step	Result / Action to Take
H1 CHECK THE STEERING WHEEL CONTROLS SWITCH RESISTANCES	
• Ignition OFF. • Disconnect: Audio Unit C290b (Except Navigation). • Disconnect: Audio Unit C2253a (Navigation). • Ignition ON. • While pressing the steering wheel controls, measure the resistance between the audio unit, C290b-18, circuit 8-MD26 (WH/BK) harness side and the audio unit C290b-19, circuit 31S-MD26 (BK/RD), harness side; or between the navigation audio unit	**Yes** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair.

C2253a-18, circuit 8-MD26 (WH/BK), harness side and the navigation audio unit C2253a-19, circuit 31S-MD26 (BK/RD), harness side. **Switch (Except Navigation) / Switch (Navigation) / Resistance Range** VOL down / MEDIA / 53.1-57 ohms VOL up / NEXT / 145.3-151 ohms SEEK up / VOL up / 297.7-307 ohms SEEK down / VOL down / 556.1-570 ohms MEDIA / REPEAT / 1,026.4-1,050 ohms Phone/Mute / VOICE / 2,016.4-2,060 ohms None / None / 4,000-6,000 ohms  A0073500 • **Are the resistances within specification?**	**No** GO to H2 .
H2 CHECK CIRCUIT 8-MD26 (WH/BK) FOR AN OPEN OR SHORT TO GROUND	
• Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Clockspring C218b. • Measure the resistance between the audio unit C2253a-18 (navigation) or C290b-18 (except navigation), circuit 8-MD26 (WH/BK), harness side and the clockspring C218b-2, circuit 8-MD26 (WH/BK), harness side; and between the audio unit C2253a-18 (navigation) or C290b-18 (except navigation), circuit 8-MD26 (WH/BK), harness side and ground.  A0073501 • **Is the resistance less than 5 ohms between the audio unit and the clockspring, and greater than 10,000 ohms between the audio unit and ground?**	**Yes** GO to H3 . **No** REPAIR the circuit. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
H3 CHECK CIRCUIT 31S-MD26 (BK/RD) FOR AN OPEN OR SHORT TO GROUND	

• Disconnect: PCM C175b. • Measure the resistance between the clockspring C218b-3, circuit 31S-MD26 (BK/RD), harness side and the audio unit C2253a-19 (navigation) or C290b-19 (except navigation), circuit 31S-MD26 (BK/RD), harness side; and between the clockspring C218b-3, circuit 31S-MD26 (BK/RD), harness side and ground.  • **Is the resistance less than 5 ohms between the clockspring and the audio unit, and greater than 10,000 ohms between the clockspring and ground?**	**Yes** GO to H4 . **No** REPAIR the circuit. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
H4 CHECK THE CLOCKSPRING	
• Disconnect: Horn Switch Connector. • Measure the resistance between the clockspring C218b pin 2, component side and the horn switch connector pin 6, component side; and between the clockspring C218b pin 3, component side and the horn switch connector pin 3, component side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to H5 . **No** INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
H5 CHECK THE HORN SWITCH HARNESS	
• Check the horn switch harness for opens and shorts. • **Is the horn switch harness OK?**	**Yes** GO to H6 . **No** INSTALL a new horn switch harness. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
H6 CHECK CIRCUITS 8-MD26 (WH/BK) AND 31S-MD26 (BK/RD) FOR SHORTS TO VOLTAGE	
• Connect: Horn Switch Connector. • Install the driver air bag module. Refer to Section 501-20B . • Ignition ON. • Measure the voltage between the audio unit C2253a-18 (navigation) or C290b-18 (except navigation), circuit 8-MD26	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No**

(WH/BK), harness side and ground; and between the audio unit C2253a-19 (navigation) or C290b-19 (except navigation), circuit 31S-MD26 (BK/RD), harness side and ground.  A0073503 • **Is any voltage present?**	GO to H7 .
H7 CHECK THE CLOCKSPRING FOR SHORTS TO VOLTAGE	
• Ignition OFF. • Connect: Clockspring C218b. • Ignition ON. • Measure the voltage between the audio unit C2253a-18 (navigation) or C290b-18 (except navigation), circuit 8-MD26 (WH/BK), harness side and ground; and between the audio unit C2253a-19 (navigation) or C290b-19 (except navigation), circuit 31S-MD26 (BK/RD), harness side and ground.  A0073503 • **Is any voltage present?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** GO to H8 .
H8 CHECK THE PCM FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Connect: PCM C175b. • Ignition ON. • Measure the voltage between the audio unit C2253a-19 (navigation) or C290b-19 (except navigation), circuit 31S-MD26 (BK/RD), harness side and ground.  N0013112 • **Is any voltage present?**	**Yes** GO to H9 . **No** INSTALL new steering wheel controls. REFER to Steering Wheel Controls in this section. CLEAR the DTCs. REPEAT the self-test.
H9 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for:	**Yes** INSTALL a new PCM. REFER to Section 303-14 .

♦ corrosion ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test I: Loud Popping Sound When Cycling The Ignition Switch — CDX6 And Navigation Audio Unit Only

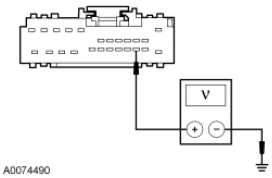
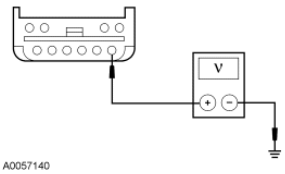
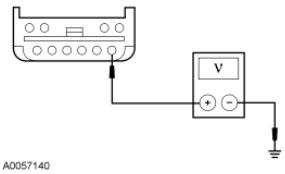
Normal Operation

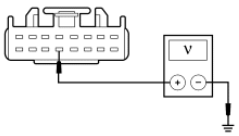
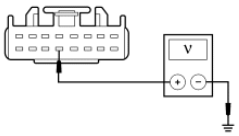
Voltage is sent to the audio unit for the start input through circuit 50-MD15 (GY/OG) when the key is placed in the START position. The audio unit then immediately mutes all speaker amplifier outputs and the subwoofer amplifier enable circuit to eliminate the possibility of speaker pops during engine cranking.

Possible Causes
- Fuse
- Circuit 7-MD12 (YE) short to voltage
- Circuit 7-MD19 (YE/RD) short to voltage
- Circuit 50-MD15 (GY/OG) open
- Audio unit
- Subwoofer amplifier
- Center imaging amplifier

PINPOINT TEST I: LOUD POPPING SOUND WHEN CYCLING THE IGNITION SWITCH — CDX6 AND NAVIGATION AUDIO UNIT ONLY

Test Step	Result / Action to Take
I1 CHECK CIRCUIT 50-MD15 (GY/OG) FOR AN OPEN	
• Ignition OFF. • Disconnect: Starter Relay C1017. • Disconnect: Audio Unit C290b or C2253a. • Hold the key in the START position. • Measure the voltage between the audio unit C2253a-15 (navigation) or C290b-15 (except navigation), circuit 50-MD15 (GY/OG), harness side and ground.	**Yes** GO to I2 . **No** VERIFY the central junction box (CJB) fuse 2 (5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

 A0074490 • **Is the voltage greater than 10 volts?**	
I2 CHECK CIRCUIT 7-MD19 (YE/RD) FOR VOLTAGE	
• Ignition OFF. • Connect: Starter Relay C1017. • Connect: Audio Unit C290b or C2253a. • Disconnect: Subwoofer Amplifier C466a. • **NOTE:** Pause in the ACC and ON positions to allow for the audio unit to power up and initialize. • Measure the voltage between the subwoofer amplifier C466a-1, circuit 7-MD19 (YE/RD), harness side and ground, while cycling the key from OFF to ACC to ON to ACC to OFF.  A0057140 • **Is voltage only present when the key is in ACC or ON?**	**Yes** For CDX6, GO to I4 . For navigation, REMOVE the subwoofer amplifier. REFER to Subwoofer Amplifier in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation. **No** GO to I3 .
I3 CHECK CIRCUIT 7-MD19 (YE/RD) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Audio Unit C290d or C2253d. • Ignition ON. • Measure the voltage between the subwoofer amplifier C466a-1, circuit 7-MD19 (YE/RD), harness side and ground.  A0057140 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair.
I4 CHECK CIRCUIT 7-MD12 (YE) FOR VOLTAGE	

• Ignition OFF. • Disconnect: Center Imaging Amplifier C225. • **NOTE:** Pause in the ACC and ON positions to allow for the audio unit to power up and initialize. • Measure the voltage between the center imaging amplifier C255-13, circuit 7-MD12 (YE), harness side and ground, while cycling the key from OFF to ACC to ON to ACC to OFF.  N0033851 • **Is voltage only present when the key is in ACC or ON?**	**Yes** GO to I6 . **No** GO to I5 .
I5 CHECK CIRCUIT 7-MD12 (YE) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Audio Unit C290d. • Ignition ON. • Measure the voltage between the center imaging amplifier C255-13, circuit 7-MD12 (YE), harness side and ground.  N0033851 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair.
I6 ISOLATE THE SUBWOOFER AMPLIFIER	
• Ignition OFF. • Connect: Audio Unit C290d. • Connect: Center Imaging Amplifier C225. • Cycle the ignition switch from OFF to ACC to ON to ACC to OFF. • **Is the concern still present?**	**Yes** REMOVE the center imaging amplifier. REFER to Audio Amplifier in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair. **No** REMOVE the subwoofer amplifier. REFER to Subwoofer Amplifier in this section. SEND it to an authorized audio system repair facility. TEST the system for normal operation after the repair.

Pinpoint Test J: No Communication With The Navigation Module

PINPOINT TEST I: LOUD POPPING SOUND WHEN CYCLING THE IGNITION SWITCH — CD266 AND NA

Normal Operation

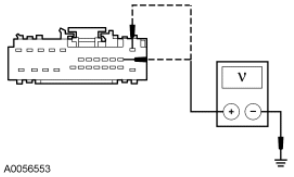
Battery voltage is supplied to the navigation module through circuit 30-GK8 (RD/BK). The driver door module (DDM) supplies voltage to the navigation module through circuit 10-GK8 (GY/BK) with the ignition switch in the ON or ACC position. Circuit 31-GK8 (BK/RD) provides the navigation module ground.

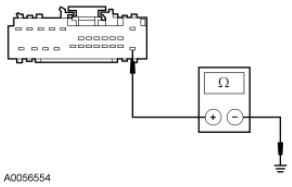
Possible Causes

- Fuse
- Circuit 10-GK8 (GY/BK) open
- Circuit 30-GK8 (RD/BK) open
- Circuit 31-GK8 (BK/RD) open
- Navigation module

PINPOINT TEST J: NO COMMUNICATION WITH THE NAVIGATION MODULE

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
J1 CHECK THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM THE DRIVER DOOR MODULE	
• Check the recorded results from the driver door module self-test. • **Are any DTCs recorded?**	**Yes** If DTC B2359, refer to Section 501-11 to continue diagnosis of DTC B2359. **No** GO to J2 .
J2 CHECK CIRCUITS 10-GK8 (GY/BK) AND 30-GK8 (RD/BK) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Navigation Module C4209. • Ignition ON. • Measure the voltage between the navigation module C4209-2, circuit 10-GK8 (GY/BK), harness side and ground; and between the navigation module C4209-1, circuit 30-GK8 (RD/BK), harness side and ground.  • **Are the voltages greater than 10.5 volts?**	**Yes** GO to J3 . **No** VERIFY the rear battery junction box (BJB) fuse 14 (10A) is OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.
J3 CHECK CIRCUIT 31-GK8 (BK/RD) FOR AN OPEN	

• Ignition OFF. • Measure the resistance between the navigation module C4209-13, circuit 31-GK8 (BK/RD), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** REFER to Section 418-00 to continue communication diagnostics. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test K: Navigation System Does Not Operate Correctly — The Global Positioning System (GPS) Antenna Signal Is Inoperative

Normal Operation

The GPS antenna provides information from the GPS satellite system to the GPS receiver in the navigation module. This information is used to calculate vehicle position and direction of travel.

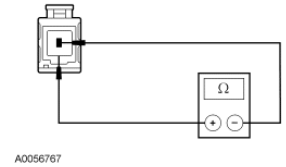
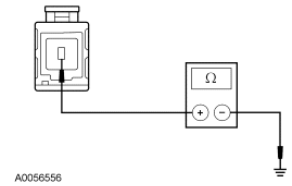
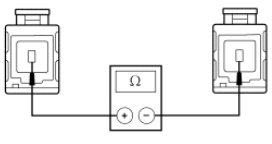
Possible Causes
- GPS antenna
- GPS antenna cable
- Navigation module

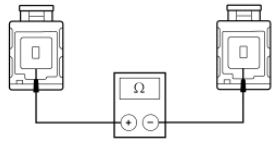
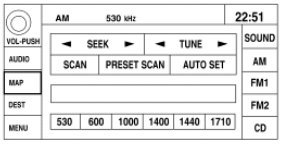
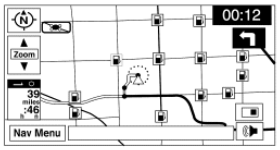
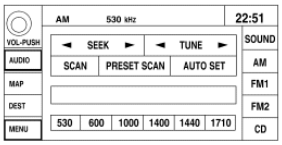
PINPOINT TEST K: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE GLOBAL POSITIONING SYSTEM (GPS) ANTENNA SIGNAL IS INOPERATIVE

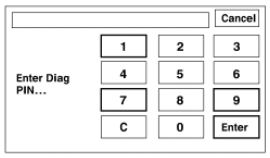
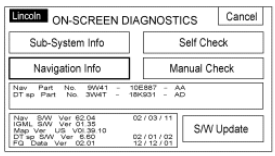
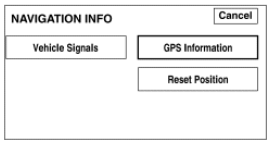
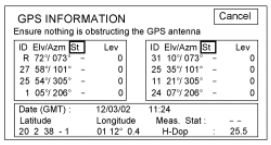
NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

NOTE: The vehicle must be driven outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges.

Test Step	Result / Action to Take
K1 CHECK THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM THE NAVIGATION MODULE	
• Check the recorded results from the navigation module self-test. • **Are any DTCs recorded?**	**Yes** For DTC B2204, GO to K2 . **No** GO to K6 .
K2 CHECK THE GPS ANTENNA FOR AN OPEN	

• Ignition OFF. • Disconnect: GPS Antenna. • Measure the resistance between the GPS antenna center conductor pin, component side and the GPS antenna shield, component side.  A0056767 • **Is the resistance between 80 and 125 ohms?**	**Yes** GO to K3 . **No** INSTALL a new GPS antenna. REFER to Global Positioning System (GPS) Antenna in this section. CLEAR the DTCs. REPEAT the self-test.
K3 CHECK THE COAXIAL CABLE CENTER CONDUCTOR FOR A SHORT TO GROUND — NAVIGATION MODULE DISCONNECTED	
• Disconnect: Navigation Module GPS Antenna.. • Measure the resistance between the navigation module GPS antenna coaxial cable center conductor pin, harness side and ground.  A0056556 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to K4 . **No** INSTALL a new antenna coaxial cable. CLEAR the DTCs. REPEAT the self-test.
K4 CHECK THE COAXIAL CABLE CENTER CONDUCTOR FOR AN OPEN	
• Measure the resistance between the GPS antenna coaxial cable center conductor pin, harness side and the navigation module GPS antenna coaxial cable center conductor pin, harness side.  A0056557 • **Is the resistance less than 5 ohms?**	**Yes** GO to K5 . **No** INSTALL a new antenna coaxial cable. CLEAR the DTCs. REPEAT the self-test.
K5 CHECK THE COAXIAL CABLE SHIELD FOR AN OPEN	

• Measure the resistance between the GPS antenna coaxial cable shield, harness side and the navigation module GPS antenna coaxial cable shield, harness side.  A0056558 • **Is the resistance less than 5 ohms?**	**Yes** GO to K9 . **No** INSTALL a new antenna coaxial cable. CLEAR the DTCs. REPEAT the self-test.
K6 CHECK THE NAVIGATION SYSTEM OPERATION	
• Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges. • Turn the audio unit on. • Press the MAP button.  A0065067  A0057837 • **Does the GPS icon disappear?**	**Yes** The system is operating correctly at this time. **No** GO to K7 .
K7 CHECK THE GPS SIGNAL STATUS	
• Press and hold the AUDIO and MENU buttons for 5 seconds.  A0055102 • Press 917 Enter.	**Yes** The system is operating correctly at this time. **No** GO to K8 .

 A0055103 • Select Navigation Info.  A0055104 • Select GPS Information.  A0055105 • Monitor the GPS status.  A0055106 • **After 10 minutes, does the ST (status) column of the GPS information display P (position) or T (tracking)?**	
K8 SUBSTITUTE THE GPS ANTENNA	
• Substitute a known good GPS antenna. • **After 10 minutes, does the ST (status) column of the GPS information display P (position) or T (tracking)?**	**Yes** INSTALL a new GPS antenna. REFER to Global Positioning System (GPS) Antenna in this section. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL the original antenna. GO to K9 .
K9 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.

make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test L: Navigation System Does Not Operate Correctly — The Position Cursor Is Inoperative

Normal Operation

The anti-lock brake system (ABS) module supplies the vehicle speed signal (VSS) to the navigation module through circuit 8-CF63 (WH/GN). The navigation system uses the VSS signal and the global positioning system (GPS) antenna to establish vehicle speed and position.

Possible Causes

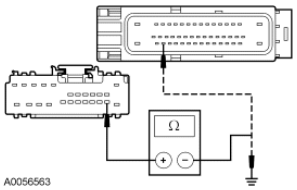
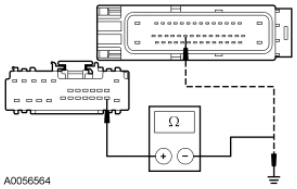
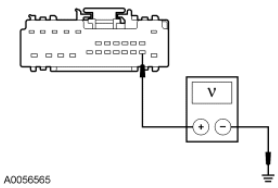
- Circuit 8-CF63 (WH/GN) open, short to ground or short to voltage
- GPS antenna
- Audio unit
- Navigation module
- ABS module

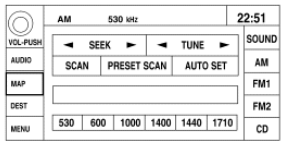
PINPOINT TEST L: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE POSITION CURSOR IS INOPERATIVE

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

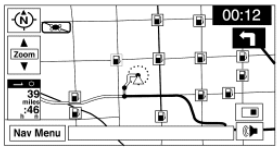
NOTE: Outdated map disc information may cause this symptom to recur at the same place.

Test Step	Result / Action to Take
L1 CHECK THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM THE NAVIGATION MODULE	
• Check the recorded results from the navigation module self-test. • **Are any DTCs recorded?**	**Yes** For DTC C1192, GO to L2 . **No** GO to L4 .
L2 CHECK CIRCUIT 8-CF63 (WH/GN) FOR AN OPEN AND A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Navigation Module C4209. • Disconnect: ABS Module. • For vehicles without stability assist, measure the resistance between the ABS module C155-3, circuit 8-CF63 (WH/GN), harness side and the navigation module C4209-14, circuit 8-CF63 (WH/GN), harness side; and between the navigation module C4209-14, circuit 8-CF63 (WH/GN), harness side and ground.	**Yes** GO to L3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 A0056563 • For vehicles with stability assist, measure the resistance between the ABS module C155-22, circuit 8-CF63 (WH/GN), harness side and the navigation module C4209-14, circuit 8-CF63 (WH/GN), harness side; and between the navigation module C4209-14, circuit 8-CF63 (WH/GN), harness side and ground.  A0056564 • **Is the resistance less than 5 ohms between the ABS module and the navigation module, and greater than 10,000 ohms between the navigation module and ground?**	
L3 CHECK CIRCUIT 8-CF63 (WH/GN) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the navigation module C4209-14, circuit 8-CF63 (WH/GN), harness side and ground.  A0056565 • **Is any voltage indicated?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to L9 .
L4 CHECK THE NAVIGATION SYSTEM OPERATION	
• Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges. • Turn the audio unit on. • Press the MAP button.	**Yes** GO to L5 . **No** GO to Pinpoint Test K .

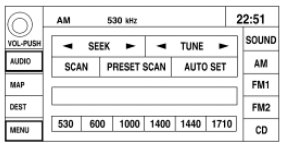
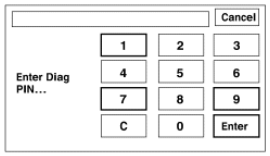
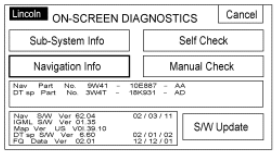
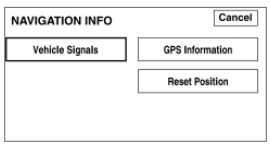


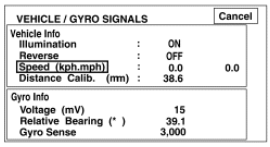
A0065067



A0057837

- **Does the GPS icon disappear?**

L5 CHECK THE VEHICLE SPEED SIGNAL INPUT	
• Press and hold the AUDIO and MENU buttons for 5 seconds.  A0055102 • Press 917 Enter.  A0055103 • Select Navigation Info.  A0055104 • Select Vehicle Signals.  A0055107	**Yes** GO to L7 . **No** If the speedometer is inoperative, REFER to Section 413-01 . If the speedometer is inaccurate, GO to L6 .

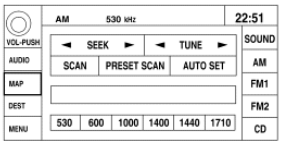


A0055108

- Drive the vehicle at a minimum speed of 5 km/h (3 mph).
- **Does the SPEED signal correspond to the speed indicated on the vehicle speedometer?**

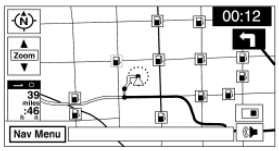
L6 CHECK THE VEHICLE SPEED SIGNAL CALIBRATION

- Select Cancel to exit from the diagnostic screens.
- Press the MAP button.



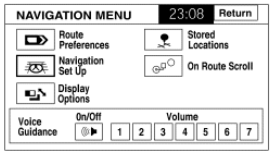
A0065067

- Select Nav Menu.



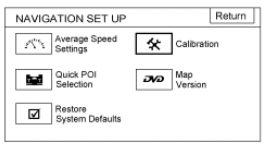
A0057838

- Select Navigation Set Up.



A0055110

- Select Calibration.

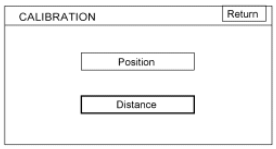
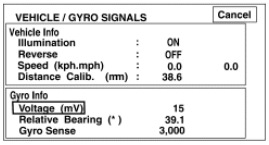


A0055111

- Select Distance.

Yes
The system is operating correctly at this time. The concern may have been caused by a speed signal calibration error.

No
GO to L8 .

 A0055112 • Drive the vehicle a minimum of 10 km (6.25 miles). • **Does the position cursor move along the course of the intended route?**	
L7 CHECK THE GYROSCOPE SIGNAL	
• Monitor the gyro voltage.  A0055113 • Drive the vehicle turning left and right. • **Does the gyro voltage change when the vehicle turns left or right?**	**Yes** GO to L8 . **No** The gyroscope is integral to the navigation module. INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.
L8 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

L9 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect all the ABS module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the ABS module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS module. REFER to Section 206-09 .
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test M: Navigation System Does Not Operate Correctly — The Voice Guidance Is Inoperative/Does Not Operate Correctly

Normal Operation

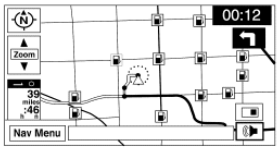
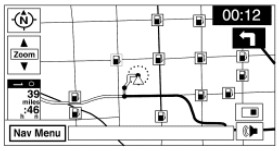
The navigation module provides voice-assisted route guidance to the audio unit through the audio circuits 1-GK18 (WH/BU) and 2-GK18 (GY/VT). The volume of the voice guidance is controlled by the audio unit.

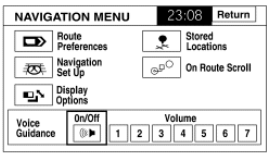
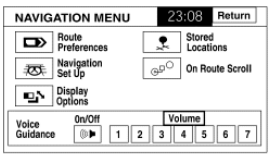
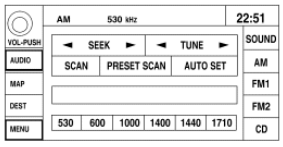
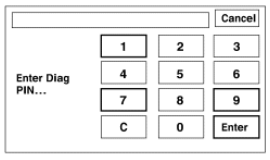
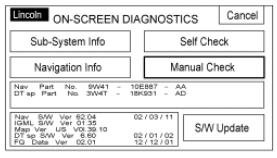
Possible Causes

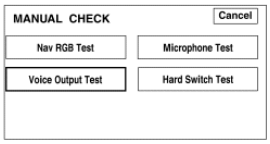
- Circuit 1-GK18 (WH/BU) open, short to ground or short to voltage
- Circuit 2-GK18 (GY/VT) open, short to ground or short to voltage
- Navigation module
- Audio unit

PINPOINT TEST M: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE VOICE GUIDANCE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

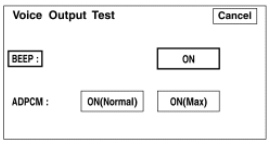
Test Step	Result / Action to Take
M1 CHECK THE SPEAKERS OPERATION	
• Ignition ON. • Turn the audio unit on. • Carry out the speaker walk-around test by pressing the MAP and DEST buttons on the audio unit while in the AM or FM mode for 5 seconds. • **Do the speakers operate correctly?**	**Yes** GO to M2 . **No** GO to Symptom Chart - Audio System in this section.
M2 CALCULATE A VEHICLE ROUTE	
• Calculate a vehicle route by setting a desired destination. • Press the voice icon on the present position screen.  A0057839 • **Does the voice guidance system operate correctly?**	**Yes** The system is operating correctly at this time. **No** GO to M3 .
M3 CHECK THE VOICE GUIDANCE	
• Select Nav Menu.  A0057838 • Select Voice Guidance.	**Yes** GO to M4 . **No** TURN ON the voice guidance system. TEST the system for normal operation.

 A0055114 • **Is the voice guidance system on the navigation menu turned on?**	
M4 CHECK THE VOICE GUIDANCE VOLUME	
• Select Volume.  A0055115 • **Is the volume adjustment set to the minimum?**	**Yes** INCREASE the sound volume. TEST the system for normal operation. **No** GO to M5 .
M5 CHECK THE AUDIO UNIT OUTPUT	
• Press and hold the AUDIO and MENU buttons for 5 seconds.  A0055102 • Press 917 Enter.  A0055103 • Select Manual Check.  A0055116 • Select Voice Output Test.	**Yes** GO to M6 . **No** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized repair facility. TEST the system for normal operation.



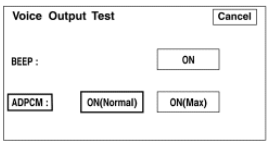
A0055117

- Select BEEP ON.

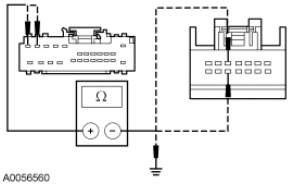
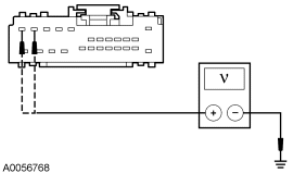


A0055118

- **Is a tone emitted by the audio unit?**

M6 CHECK THE NAVIGATION MODULE OUTPUT	
• Select ADPCM ON (Normal).  A0055119 • **Is a tone emitted by the navigation module?**	**Yes** GO to M9 . **No** GO to M7 .
M7 CHECK CIRCUITS 1-GK18 (WH/BU) AND 2-GK18 (GY/VT) FOR AN OPEN AND A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Audio Unit C2253c. • Disconnect: Navigation Module C4209. • Measure the resistances between the navigation module C4209 pins, harness side and the audio unit C2253c pins, harness side; and between the navigation module C4209 pins, harness side and ground as follows:	**Yes** GO to M8 . **No** REPAIR the circuit in question. TEST the system for normal operation.

Navigation Module Pin	Audio Unit Pin	Circuit
C4209-11	C2253c-5	1-GK18 (WH/BU)
C4209-12	C2253c-12	2-GK18 (GY/VT)

 A0056560 • **Are the resistances less than 5 ohms between the navigation module and the audio unit, and greater than 10,000 ohms between the navigation module and ground?**	
M8 CHECK CIRCUITS 1-GK18 (WH/BU) AND 2-GK18 (GY/VT) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the navigation module C4209-11, circuit 1-GK18 (WH/BU), harness side and ground; and between the navigation module C4209-12, circuit 2-GK18 (GY/VT), harness side and ground.  A0056768 • **Is any voltage indicated?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to M9 .
M9 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: Navigation System Does Not Operate Correctly — The Display Screen Is Inoperative

Normal Operation

The audio unit display is controlled by the navigation module. Video color is provided through circuits 10-GK24 (GY/RD), 10-GK25 (GY/OG), and 10-GK26 (GY/VT). Circuit 8-GK35 (WH) provides the color synchronization and circuit 9-GK35 (BN) is the video signal return.

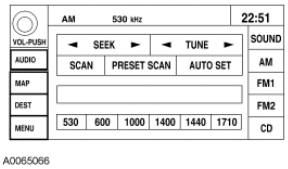
Possible Causes

- Circuit 8-GK35 (WH) open, short to ground or short to voltage
- Circuit 9-GK35 (BN) open, short to ground or short to voltage

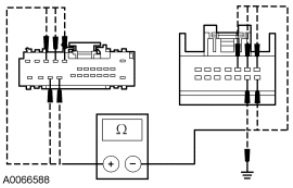
- Circuit 10-GK24 (GY/RD) open, short to ground or short to voltage
- Circuit 10-GK25 (GY/OG) open, short to ground or short to voltage
- Circuit 10-GK26 (GY/VT) open, short to ground or short to voltage
- Navigation module
- Audio unit

PINPOINT TEST N: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE DISPLAY SCREEN IS INOPERATIVE

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
N1 CHECK THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM THE NAVIGATION MODULE	
• Check the recorded results from the navigation module self-test. • **Are any DTCs recorded?**	**Yes** For DTC B2208, GO to Pinpoint Test R to diagnose the audio unit. For all other DTCs, REFER to the Navigation Module Diagnostic Trouble Code (DTC) Index in this section. **No** GO to N2 .
N2 CHECK THE AUDIO UNIT BUTTONS	
• Press the MAP, AUDIO, DEST, and MENU buttons.  A0065066 • **Does the display screen operate correctly?**	**Yes** The system is operating correctly at this time. The concern may have been caused by a SCREEN OFF selection on the MENU screen. **No** GO to N3 .
N3 CHECK THE VIDEO AND SYNCHRONIZATION CIRCUITS FOR AN OPEN AND A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Audio Unit C2253c. • Disconnect: Navigation Module C4209. • Measure the resistances between the navigation module C4209 pins harness side and the audio unit C2253c pins harness side; and between the navigation module C4209 pins harness side and ground as follows:	**Yes** GO to N4 . **No** REPAIR the circuit in question. TEST the system for normal operation.

Navigation Module Pin	Audio Unit Pin	Circuit
C4209-8	C2253c-1	10-GK24 (GY/RD)
C4209-9	C2253c-8	10-GK26 (GY/VT)
C4209-10	C2253c-3	9-GK35 (BN)
C4209-21	C2253c-2	10-GK25 (GY/OG)
C4209-22	C2253c-9	8-GK35 (WH)

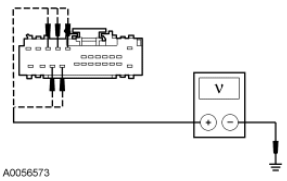


- **Are the resistances less than 5 ohms between the navigation module and the audio unit, and greater than 10,000 ohms between the navigation module and ground?**

N4 CHECK THE VIDEO AND SYNCHRONIZATION CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure the voltage between the navigation module C4209 pins harness side and ground as follows:

Navigation Module Pin	Circuit
C4209-8	10-GK24 (GY/RD)
C4209-9	10-GK26 (GY/VT)
C4209-10	9-GK35 (BN)
C4209-21	10-GK25 (GY/OG)
C4209-22	8-GK35 (WH)



- **Is any voltage indicated?**

Yes
REPAIR the circuit the question. TEST the system for normal operation.

No
GO to N5 .

N5 SUBSTITUTE THE AUDIO UNIT

- Substitute a known good audio unit.

Yes
REMOVE the audio unit. REFER to

• **Does the screen display appear?**	Audio Unit in this section. SEND it to an authorized repair facility. TEST the system for normal operation. **No** INSTALL the original audio unit. GO to N6 .
N6 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test O: Navigation System Does Not Operate Correctly — The Navigation Screen Is Inoperative

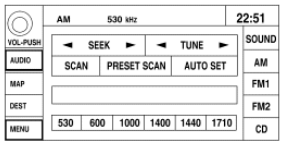
Normal Operation

The screen display of the audio unit for audio and navigation is controlled by the navigation module. A map digital versatile disc (DVD) stored in the navigation module sends route data to the audio unit through the video interface circuits.

Possible Causes
- Navigation system map DVD
- Navigation module
- Audio unit

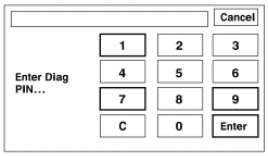
PINPOINT TEST O: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE NAVIGATION SCREEN IS INOPERATIVE

Test Step	Result / Action to Take
O1 CHECK THE SWITCH DISPLAY	
• Ignition ON. • Turn the audio unit on. • Press and hold the AUDIO and MENU buttons for 5 seconds.	**Yes** GO to O2 . **No** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized repair facility. TEST the system for normal operation.



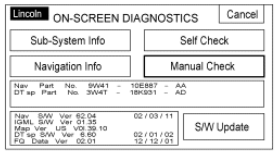
A0055102

- Press 917 Enter.



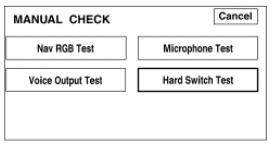
A0055103

- Select Manual Check.



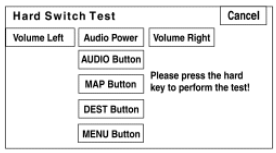
A0055116

- Select Hard Switch Test.



A0055120

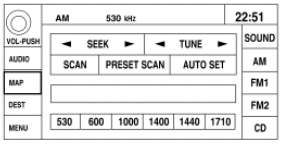
- Push each switch on the display.



A0055121

- **Are all of the switches operating correctly?**

O2 CHECK MAP DISC SURFACE	
• Ignition OFF. • Ignition ON. • Visually inspect the map disc surface. • **Is the map disc dirty or scratched?**	**Yes** INSTALL a new map disc. TEST the system for normal operation. **No** INSTALL the map disc. GO to O3 .
O3 CHECK THE MAP DISPLAY	

• Ignition OFF. • Ignition ON. • Press the MAP button.  A0065067 • **Is the map displayed?**	**Yes** The system is operating correctly at this time. **No** GO to O4 .
O4 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test P: Navigation System Does Not Operate Correctly — The Audible Switches Are Inoperative

Normal Operation

The audible switch feedback settings are controlled by the audio unit. The notification can be set to ALL, TOUCH SCREEN, or NONE depending on user preference.

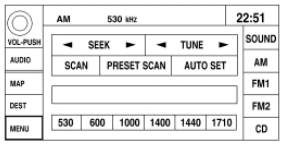
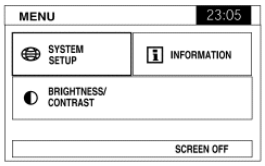
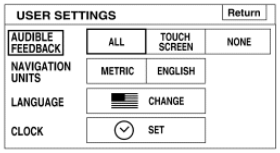
Possible Causes

- Audio unit

PINPOINT TEST P: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE AUDIBLE SWITCHES ARE INOPERATIVE

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
P1 CHECK THE SWITCH DISPLAY	

• Ignition ON. • Turn the audio unit on. • Press the MENU button.  A0066586 • Select SYSTEM SETUP.  A0055122 • Select AUDIBLE FEEDBACK.  A0055123 • **Is NONE highlighted on the audible feedback settings?**	**Yes** SELECT ALL. TEST the system for normal operation. **No** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized repair facility. TEST the system for normal operation.

Pinpoint Test Q: Navigation System Does Not Operate Correctly — Unable to Insert or Eject Map Disc

Normal Operation

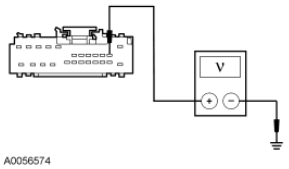
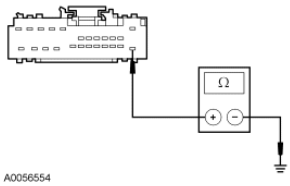
The navigation map disc is contained in the navigation module. The voltage is supplied to the navigation module with the key in the ON or ACC position through 10-GK8 (GY/BK). Circuit 31-GK8 (BK/RD) supplies the navigation module ground.

Possible Causes

- Circuit 10-GK8 (GY/BK) open or short to ground
- Circuit 31-GK8 (BK/RD) open
- Navigation module

PINPOINT TEST Q: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — UNABLE TO INSERT OR EJECT MAP DISC

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
Q1 CHECK CIRCUIT 10-GK8 (GY/BK) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Navigation Module C4209. • Ignition ON. • Measure the voltage between the navigation module C4209-2, circuit 10-GK8 (GY/BK), harness side and ground.  A0056574 • **Is the voltage greater than 10 volts?**	**Yes** GO to Q2 . **No** REPAIR the circuit. TEST the system for normal operation.
Q2 CHECK CIRCUIT 31-GK8 (BK/RD) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the navigation module C4209-13, circuit 31-GK8 (BK/RD), harness side and ground.  A0056554 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q3 . **No** REPAIR the circuit. TEST the system for normal operation.
Q3 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test R: Navigation System Does Not Operate Correctly — The Audio Unit Is Inoperative

Normal Operation

The navigation module communicates to the audio unit through circuits 5-GK8 (BU/YE) and 4-GK8 (GY/BK) using the controller area network (CAN) protocol. Battery voltage is supplied to the audio unit through circuit 29-MD15 (OG/BK). Circuit 10-MD15 (GY/OG) provides voltage to the audio unit with the key in the ON or ACC position. The audio unit ground is supplied through circuits 31-MD15B (BK/GN) and 31-MD15A (BK/GN).

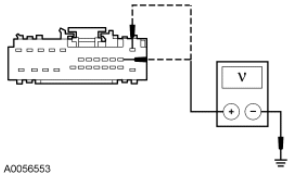
Possible Causes

- Fuse
- Circuit 4-GK8 (GY/BK) open, short to ground or short to voltage
- Circuit 5-GK8 (BU/YE) open, short to ground or short to voltage
- Circuit 10-MD15 (GY/OG) open or short to ground
- Circuit 29-MD15 (OG/BK) open or short to ground
- Circuit 31-MD15A (BK/GN) open
- Circuit 31-MD15B (BK/GN) open
- Navigation module
- Audio unit

PINPOINT TEST R: NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY — THE AUDIO UNIT IS INOPERATIVE

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

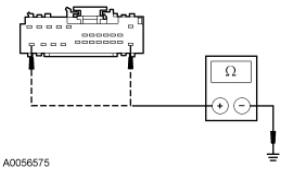
Test Step	Result / Action to Take
R1 CHECK THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCs) FROM THE NAVIGATION MODULE	
• Check the recorded results from the navigation module self-test. • **Are any DTCs recorded?**	**Yes** For DTC B2208, GO to R2 . **No** GO to Pinpoint Test N to diagnose the video circuits.
R2 CHECK CIRCUITS 10-MD15 (GY/OG) AND 29-MD15 (OG/BK) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Audio Unit C2253a. • Ignition ON. • Measure the voltage between the audio unit C2253a-2, circuit 10-MD15 (GY/OG), harness side and ground; and between the audio unit C2253a-1, circuit 29-MD15 (OG/BK), harness side and ground .	**Yes** GO to R3 . **No** VERIFY the central junction box (CJB) fuse 18 (20A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. TEST the system for normal operation.



- **Are the voltages greater than 10 volts?**

R3 CHECK CIRCUITS 31-MD15A (BK/GN) AND 31-MD15B (BK/GN) FOR AN OPEN

- Ignition OFF.
- Measure the resistance between the audio unit C2253a-24, circuit 31-MD15A (BK/GN), harness side and ground; and between the audio unit C2253a-13, circuit 31-MD15B (BK/GN), harness side and ground.



- **Are the resistances less than 5 ohms?**

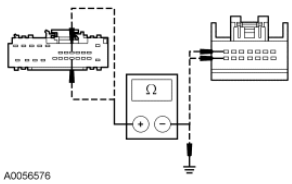
Yes
GO to R4 .

No
REPAIR the circuit in question. CLEAR the DTCs. TEST the system for normal operation.

R4 CHECK CIRCUITS 4-GK8 (GY/BK) AND 5-GK8 (BU/YE) FOR AN OPEN AND A SHORT TO GROUND

- Disconnect: Navigation Module C4209.
- Disconnect: Audio Unit C2253c.
- Measure the resistances between the navigation module C4209 pins, harness side and audio unit C2253c pins, harness side; and between the navigation module C4209 pins, harness side and ground as follows:

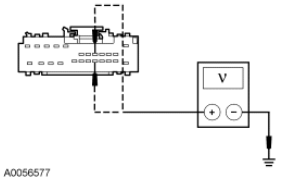
Navigation Module Pin	Audio Unit Pin	Circuit
C4209-5	C2253c-7	4-GK8 (GY/BK)
C4209-17	C2253c-14	5-GK8 (BU/YE)



- **Are the resistances less than 5 ohms between the navigation module and the audio unit, and greater than 10,000 ohms between the navigation module and**

Yes
GO to R5 .

No
REPAIR the circuit in question. CLEAR the DTCs. TEST the system for normal operation.

ground?	
R5 CHECK CIRCUITS 4-GK8 (GY/BK) AND 5-GK8 (BU/YE) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the navigation module C4209-5, circuit 4-GK8 (GY/BK), harness side and ground; and between the navigation module C4209-17, circuit 5-GK8 (BU/YE), harness side and ground.  • **Is any voltage indicated?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. TEST the system for normal operation. **No** GO to R6 .
R6 SUBSTITUTE THE AUDIO UNIT	
• Substitute a known good audio unit. • Repeat the navigation module self-test. • **Is DTC B2208 present?**	**Yes** INSTALL the original audio unit. GO to R7 . **No** REMOVE the audio unit. REFER to Audio Unit in this section. SEND it to an authorized repair facility. CLEAR the DTCs. TEST the system for normal operation.
R7 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test S: DTC B2633 Driver — Front Microphone Circuit Failure

Normal Operation

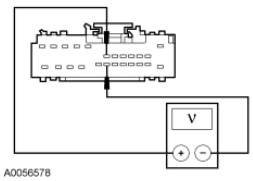
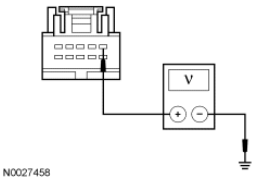
The navigation system microphone is integrated into the rear view mirror. The microphone supplies a voice signal to the navigation module through circuits 8-MC8 (WH/RD) and 9-MC8 (BN/RD). The rear view mirror receives switched B+ voltage through circuit 75-AD15 (YE/BU). Circuit 31-AD15 (BK/OG) provides the mirror ground.

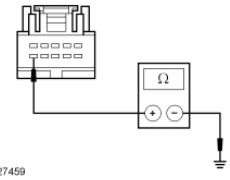
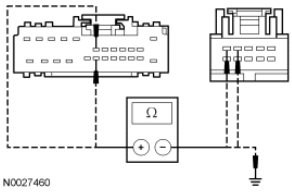
Possible Causes

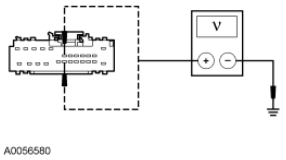
- Circuit 8-MC8 (WH/RD) open, short to ground or short to voltage
- Circuit 9-MC8 (BN/RD) open, short to ground or short to voltage
- Circuit 31-AD15 (BK/OG) open
- Circuit 75-AD15 (YE/BU) open or short to ground
- Microphone
- Navigation module

PINPOINT TEST S: DTC B2633 DRIVER — FRONT MICROPHONE CIRCUIT FAILURE

NOTICE: **Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
S1 CHECK THE VOICE SIGNAL FROM THE MICROPHONE	
• Ignition OFF. • Disconnect: Navigation Module C4209. • Ignition ON. • Measure the voltage between the navigation module C4209-7, circuit 8-MC8 (WH/RD), harness side and between the navigation module C4209-19, 9-MC8 (BN/RD), harness side while speaking loudly into the rear view mirror microphone.  A0056578 • **Is any AC voltage indicated?**	**Yes** GO to S6 . **No** GO to S2 .
S2 CHECK CIRCUIT 75-AD15 (YE/BU) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Rear View Mirror C911. • Ignition ON. • Measure the voltage between the rear view mirror C911-1, circuit 75-AD15 (YE/BU), harness side and ground.  N0027458 • **Is the voltage greater than 10 volts?**	**Yes** GO to S3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
S3 CHECK CIRCUIT 31-AD15 (BK/OG) FOR AN OPEN	

• Ignition OFF. • Measure the resistance between the rear view mirror C911-10, circuit 31-AD15 (BK/OG), harness side and ground.  N0027459 • **Is the resistance less than 5 ohms?**	**Yes** GO to S4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
S4 CHECK CIRCUITS 8-MC8 (WH/RD) AND 9-MC8 (BN/RD) FOR AN OPEN AND A SHORT TO GROUND	
• Measure the resistances between the navigation module C4209 pins, harness side and the rear view mirror C911 pins, harness side; and between the navigation module C4209 pins, harness side and ground as follows: **Navigation Module Pin** / **Rear View Mirror Pin** / **Circuit** C4209-7 / C911-4 / 8-MC8 (WH/RD) C4209-19 / C911-5 / 9-MC8 (BN/RD)  N0027460 • **Are the resistances less than 5 ohms between the navigation module and the rear view mirror, and greater than 10,000 ohms between the navigation module and ground?**	**Yes** GO to S5 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
S5 CHECK CIRCUITS 8-MC8 (WH/RD) AND 9-MC8 (BN/RD) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the navigation module C4209-7, circuit 8-MC8 (WH/RD), harness side and ground; and between the navigation module C4209-19, circuit 9-MC8 (BN/RD), harness side and ground.	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new rear view mirror. REFER to Section 501-09 . CLEAR the DTCs. REPEAT the self-test.

 A0056580 • **Is any voltage indicated?**	
S6 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. TEST the system for normal operation.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test T: DTC U1016 — SCP Invalid Data Powertrain Control Module

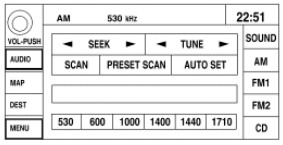
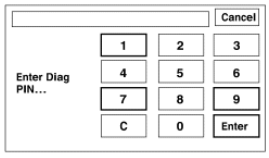
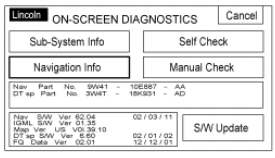
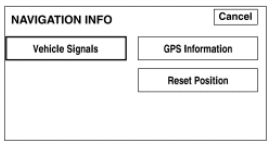
Normal Operation

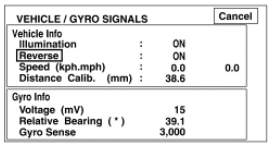
The navigation module receives a vehicle in reverse signal from the powertrain control module (PCM) through the standard corporate protocol (SCP) network.

Possible Causes
- navigation module
- PCM

PINPOINT TEST T: DTC U1016 — SCP INVALID DATA POWERTRAIN CONTROL MODULE

Test Step	Result / Action to Take
T1 CHECK THE RECORDED DTCS FROM THE PCM	
• Check the recorded results from the PCM self-test. • **Are any DTCs recorded?**	**Yes** For PXXX codes, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. For all other codes, REFER to Section 419-10 . **No** GO to T2 .
T2 MONITOR THE PCM REVERSE INPUT	

• Enter the following diagnostic mode on the scan tool: PCM PID Monitor. • Monitor the transmission range (TR) sensor PID. • Place the selector lever in REVERSE. • **Does the TR sensor PID indicate correctly?**	**Yes** GO to T3 . **No** REFER to Section 307-01 to continue diagnosis of the input.
T3 CHECK THE REVERSE SIGNAL INPUT	
• Press and hold the AUDIO and MENU buttons for 5 seconds.  A0055102 • Press 917 Enter.  A0055103 • Select Navigation Info.  A0055104 • Select Vehicle Signals.  A0055107	**Yes** CLEAR the DTCs. REPEAT the self-test. IF DTC U1016 is retrieved again, GO to T4 . **No** GO to T4 .

 A0068110 • **Does the reverse signal indicate ON?**	
T4 CHECK FOR CORRECT NAVIGATION MODULE OPERATION	

• Disconnect all the navigation module connectors.
• Check for:
  • corrosion
  • pushed-out pins
• Connect all the navigation module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new navigation module. REFER to Navigation Module in this section. CLEAR the DTCs. REPEAT the self-test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Audio Unit Part Number Retrieval

Audio Units Without Navigation

NOTE: The audio unit must be in radio tuner (AM/FM) mode to retrieve the part number.

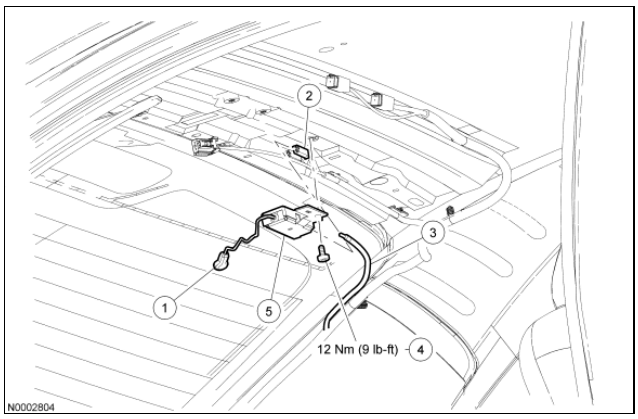
1. Turn the audio unit on.
2. Press and hold preset buttons 3 and 6 for 3 seconds. The speaker walk-around test will begin.
3. Before the speaker walk-around test is complete, press preset button 6.
4. Press the TUNE UP button. This will either directly indicate the part number or it will cause the audio unit to scroll through config 1, config 2, EEPROM, and the part number information.
    - If the audio unit scrolls through the information, Step 4 may need to be repeated until the audio unit part number can be recorded.
5. Record the audio unit part number.
6. Turn the audio unit off.

Audio Units With Navigation

1. Turn the audio unit on.
2. Press and hold the AUDIO and MENU buttons for 5 seconds.
3. Enter code "917" in the DIG PIN field and press ENTER.
4. **NOTE:** The audio unit part number is displayed in the third box.

   Record the audio unit part number.
5. Turn the audio unit off.

Antenna Isolator Module



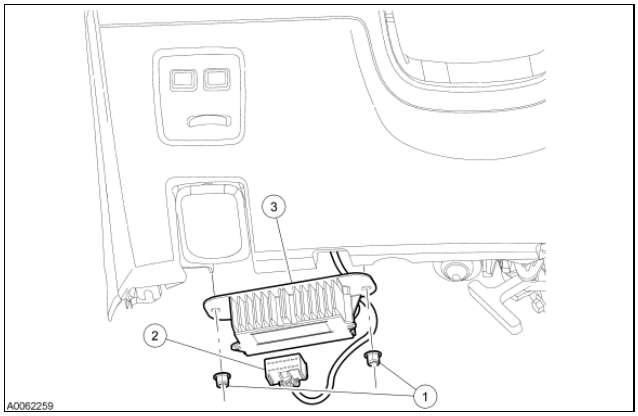
Item	Part Number	Description
1	—	Antenna connector (part of 18C847)
2	14489	Antenna isolator module electrical connector
3	14489	Antenna cable
4	—	Antenna isolator module bolt (part of 18C847)
5	18C847	Antenna isolator module

Removal and Installation

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. Remove the LH and RH rear quarter panel trim panels. For additional information, refer to Section 501-05 .
3. Lower the rear of the headliner.
4. Disconnect the antenna connector from the back glass.
5. Disconnect the antenna isolator module electrical connector.
6. Disconnect the antenna cable.
7. Remove the bolt and the antenna isolator module.
    - To install, tighten to 12 Nm (9 lb-ft).
8. To install, reverse the removal procedure.

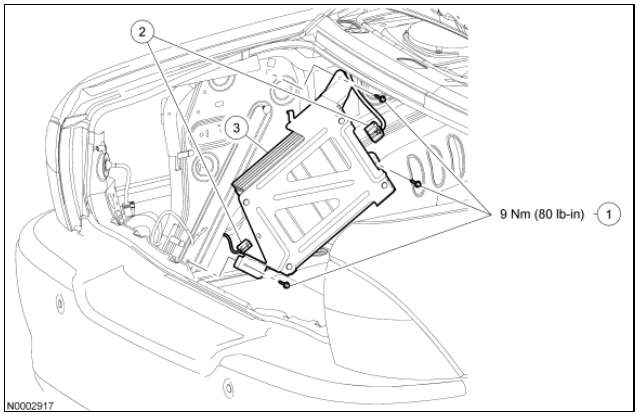
Audio Amplifier

Center Imaging Amplifier



Item	Part Number	Description
1	520201	Center imaging amplifier nuts (2 required)
2	—	Center imaging amplifier electrical connector (part of 14489)
3	18T805A	Center imaging amplifier and bracket

Audio Unit Amplifier



Item	Part Number	Description
1	806886	Audio amplifier screws (3 required)
2	—	Audio amplifier electrical connectors (part of 14A005)
3	18T806	Audio amplifier and bracket

Removal and Installation

All Amplifiers

1. Disconnect the battery. For additional information, refer to Section 414-01 .

Center Imaging Amplifier

2. Remove the driver cowl side trim panel.

3. Remove the 2 center imaging amplifier nuts and the center imaging amplifier.
    - Disconnect the center imaging amplifier electrical connector.

Audio Unit Amplifier

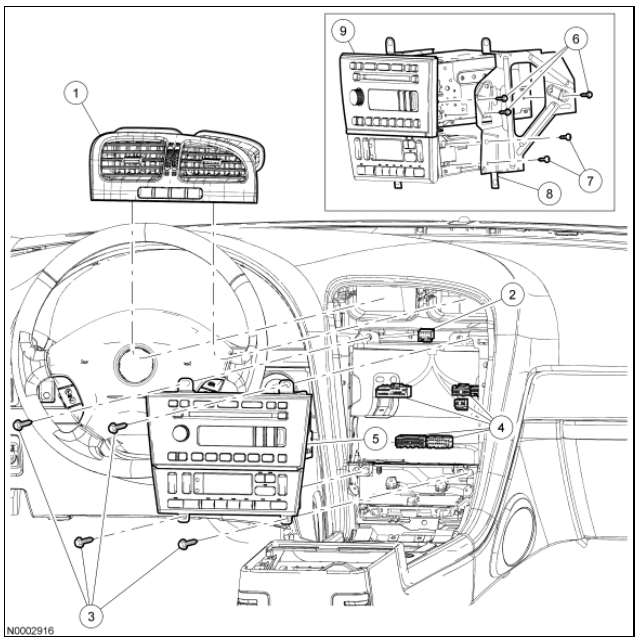
4. Remove the LH trunk trim panel.

5. Remove the 3 audio amplifier screws and the audio amplifier and bracket.
    - Disconnect the audio amplifier electrical connectors.
    - To install, tighten to 9 Nm (80 lb-in).

All Amplifiers

6. To install, reverse the removal procedure.

Audio Unit



Item	Part Number	Description
1	19C894	Center register panel
2	—	Center register panel electrical connector (part of 14401)
3	—	Audio unit/dual automatic temperature control (DATC) assembly screws (4 required)
4	—	Audio unit/dual automatic temperature control (DATC) assembly electrical connectors (part of 14401)
5	150102, 120403	Audio unit/dual automatic temperature control (DATC) assembly
6	—	Audio unit screws (6 required)
7	—	Climate control screws (4 required)
8	404452/ 404453	Brackets (RH/LH)
9	150102	Audio unit

Removal and Installation

NOTE: It is not necessary to remove the audio unit to retrieve the part number. For additional information, refer to Audio Unit Part Number Retrieval in this section.

1. Remove the floor console finish panel.
   - Pull upward from the front of the floor console finish panel to release the retainers.

2. Remove the 4 screws and the console ash tray assembly.
   - Disconnect the electrical connectors.

3. Remove the center register panel.
   - Disconnect the electrical connector.

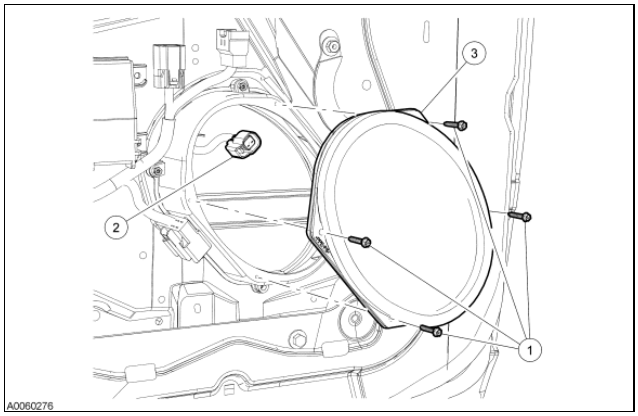
4. Remove the 4 screws and the audio unit/dual automatic temperature control (DATC) assembly.
    - Disconnect the electrical connectors and the antenna cable.

5. Remove the 6 screws and the audio unit from the bracket.

6. To install, reverse the removal procedure.

Door Speaker

NOTE: Front door speaker shown, rear door speaker similar.



Item	Part Number	Description
1	W701930-S	Door speaker screws (4 required)
2	14A005	Door speaker electrical connector
3	18808	Door speaker

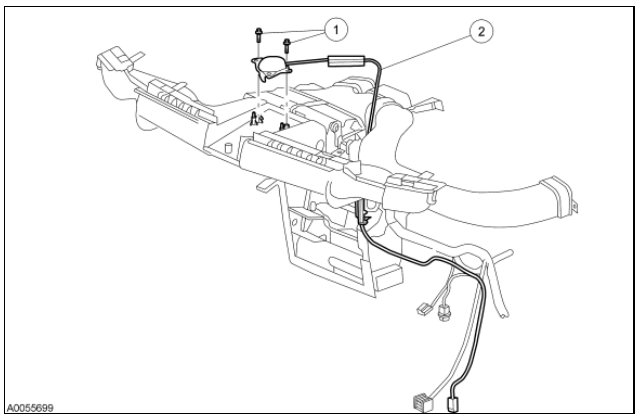
Removal and Installation

1. Remove the door trim panel. For additional information, refer to Section 501-05 .

2. Remove the 4 screws and the door speaker.
   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

Global Positioning System (GPS) Antenna

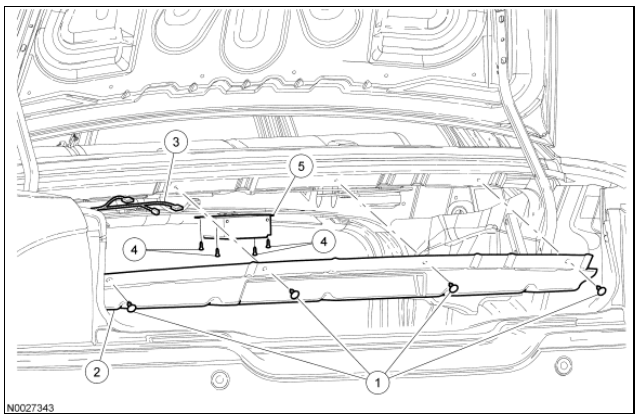


Item	Part Number	Description
1	N807011	GPS antenna screws (2 required)
2	10E893	GPS antenna and cable

Removal and Installation

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. Remove the defroster duct. For additional information, refer to Section 412-00 .
3. Remove the 2 GPS antenna screws.
4. Disconnect the cable and remove the GPS antenna.
5. To install, reverse the removal procedure.

Navigation Module



Item	Part Number	Description
1	811405	Pin-type retainers (4 required)
2	445443	Luggage compartment front cover
3	—	Navigation module electrical connectors (part of 14A005)
4	W706919	Navigation module screws (4 required)
5	10E887	Navigation module

Removal and Installation

1. ***NOTICE:*** **Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.**

   NOTE: Prior to removal of the navigation system module, it is necessary to remove the digital versatile disc (DVD) from the navigation system module and store it in the customer case.

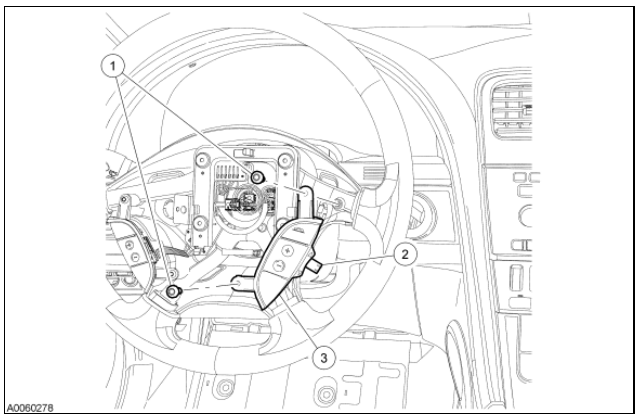
   Disconnect the battery. For additional information, refer to Section 414-01 .

2. Remove the 4 pin-type retainers and the luggage compartment front cover.

3. Remove the 4 screws and the navigation module.
   - Disconnect the electrical connectors.

4. To install, reverse the removal procedure.

Steering Wheel Controls



Item	Part Number	Description
1	15835-035	Steering wheel control switch screws (2 required)
2	—	Steering wheel control switch electrical connector (part of 13A876)
3	14K147-A	Steering wheel control switches

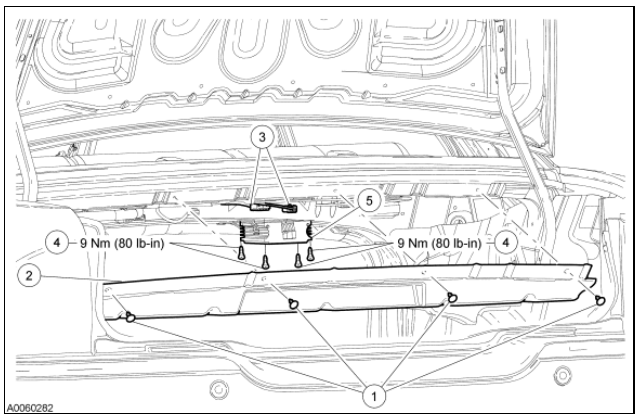
Removal and Installation

1. Remove the driver air bag module. For additional information, refer to Section 501-20B .

2. Remove the 2 screws and the steering wheel control switch.
   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

Subwoofer Amplifier



Item	Part Number	Description
1	811405	Pin-type retainers (4 required)
2	445443	Luggage compartment front cover
3	—	Subwoofer amplifier electrical connectors (part of 14A005)
4	—	Subwoofer amplifier screws (4 required)
5	150103	Subwoofer amplifier and bracket

Removal and Installation

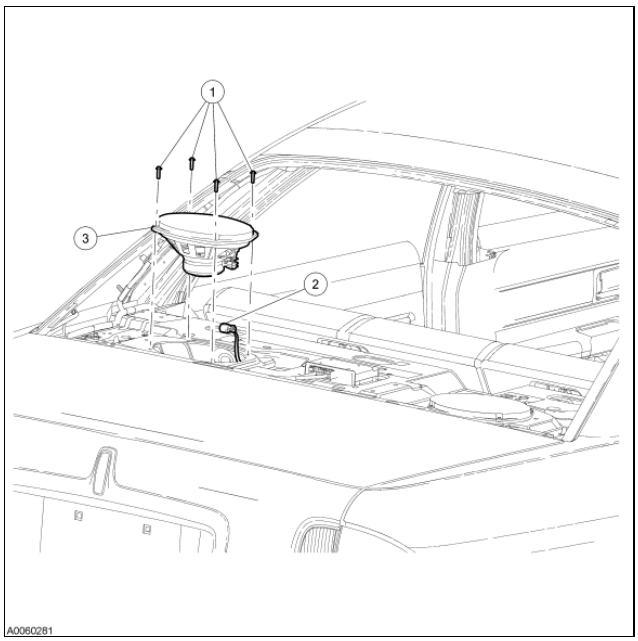
1. Disconnect the battery. For additional information, refer to Section 414-01 .

2. Remove the 4 pin-type retainers and the luggage compartment front cover.

3. Remove the 4 screws and the subwoofer amplifier and bracket.
   - Disconnect the electrical connectors.
   - To install, tighten to 9 Nm (80 lb-in).

4. To install, reverse the removal procedure.

Subwoofer Speaker



Item	Part Number	Description
1	701930	Subwoofer speaker screws (4 required)
2	14A005	Subwoofer speaker electrical connector
3	18808	Subwoofer speaker

Removal and Installation

1. Remove the parcel shelf trim panel. For additional information, refer to Section 501-05 .

2. Remove the 4 screws and the subwoofer speaker.
   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

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Torque Specifications

Description	Nm	lb-in
Fog lamp nuts	5	44
Rear lamp nuts	5	44
High mounted stoplamp screws	5	44

Exterior Lighting

NOTE: The front electronic module (FEM), the rear electronic module (REM) and the instrument cluster must be reconfigured before installing a new module. For additional information, refer to Section 418-01 .

The vehicle electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. It is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- if the module which received the input (message) controls the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Lamp Assembly Condensation

Exterior lamps are vented to accommodate normal changes in pressure. Condensation can be a natural by-product of this design. When moist air enters the lamp assembly through the vents, there is a possibility that condensation can occur if the temperature is cold. When normal condensation occurs, a thin film of mist can form on the interior of the lens. The thin mist eventually clears and exits through the vents during normal operation. Time to clear the lens of acceptable mist varies with ambient humidity and lamp types. Normal condensation clears from any lamp in 48 hours under dry conditions.

Do **not** replace a lamp assembly with acceptable levels of condensation such as:

- presence of thin mist (no streaks, drip marks or droplets are present)
- fine mist covers less than 50% of the lens

Examples of unacceptable moisture (usually caused by a lamp housing leak):

- water puddling inside the lamp
- large water droplets, drip marks or streaks present on the interior of the lens

Exterior Lighting

The exterior lighting outputs are zone controlled by the FEM and REM. The front exterior lights are controlled by the FEM and the rear exterior lights are controlled by the REM. An additional function of the lighting system is a lamp outage function which indicates to the driver if certain exterior bulbs are not functioning. With a bulb inoperative, the FEM or REM will send a message to the instrument cluster and message center (if equipped with the message center), which will indicate to the driver that the lamp is inoperative with a lamp out indicator (with the message center a message will be displayed). All exterior lighting is powered by the switched system power (SSP) feature. For additional information, refer to Switched System Power. A failure of all or any of the SSP features will cause inoperative exterior lighting. When diagnosing exterior lighting, it is essential to determine if all related symptoms and DTCs are controlled by the SSP feature.

Switched System Power (SSP)

The SSP is utilized by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3 and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, refer to the SSP Index for diagnosis and testing of SSP-related issues.

Headlamps

The headlamps are controlled by the FEM and the instrument cluster. The headlamp and multifunction switches are hard-wired to the instrument cluster. When the headlamp switch is in any position, the instrument cluster will send a command to the FEM through the SCP communication network. The FEM will process this information and output the appropriate command to the headlamps, which are hard-wired to the FEM (if equipped with high intensity discharge (HID) headlamps, the HID relays are hard-wired to and controlled by the FEM). This is the same for the low and high beams and flash-to-pass position. Either low or high beam will provide a lamp outage indication (halogen bulbs only). Fault management of the headlamps will provide some headlamp functionality. In the event of all multifunction switch, all headlamp switch or ignition switch invalid or missing data failures, the low beams will be illuminated. There is also a headlamp battery saver feature. This feature turns off the headlamps 10 minutes after the ignition switch is turned OFF when the headlamp switch is in the headlamps ON position. The battery saver does not function if the headlamp switch is in the parking lamps ON position.

NOTE: Daytime running lamps (DRL) feature is available for Canadian vehicles only.

Autolamps and DRL are 2 functions which the FEM may be configured to include.

Autolamps

The autolamps are controlled by the headlamp switch, photocell sensor, instrument cluster and the FEM. The headlamps may be in the high or low beam position depending on the multifunction switch position. When the headlamp switch is in the autolamp position, the instrument cluster sends an ON or OFF command to the FEM, depending on the signal from the autolamp sensor. The FEM processes this information and outputs the appropriate command to the headlamps. The headlamps are hard-wired to the FEM. The autolamps remain ON for approximately 20 seconds to 3 minutes (depending on customer preferences) after the ignition switch is changed from the ON position to the ACC or OFF position.

Turn Signal, Cornering and Hazard Lamps

The LH and RH front turn signal, LH and RH rear turn signal outputs, and front and rear hazard lamp outputs are controlled by the FEM and REM. The multifunction switch and the hazard switch are hard-wired to the instrument cluster. When the switch is in the left- or right-turn position, or the hazard switch is in the ON position, the instrument cluster sends a command through the standard corporate protocol (SCP) network to the FEM and REM, which processes this information and outputs the appropriate command to the front and rear turn signal and hazard lamps. All turn signal lamps will provide lamp outage indication.

Parking, Rear or License Plate Lamps

For the LH and RH rear parking, license plate, and LH and RH front parking lamps, outputs are controlled by the FEM and REM. The headlamp switch is hard-wired to the instrument cluster. When the headlamp switch is in the headlamps ON or parking lamps ON position, the instrument cluster sends a command via the network link to the FEM and REM. The FEM and REM process this information and output the appropriate command to the parking or license plate lamps, which are hard-wired to the FEM and REM. Only the left and

right rear lamps will provide lamp outage indication. Fault management of the parking lamps provides rear parking lamp functionality in the event of certain multifunction switch, headlamp switch, ignition switch, FEM or REM failures.

Fog Lamps

The fog lamps are controlled by the headlamp switch. The switch toggles the fog lamps between on and off. When activated, the switch sends voltage to the instrument cluster. The instrument cluster sends a signal to the FEM which activates the fog lamp.

Reversing Lamps

The reversing lamps are controlled by the REM and powertrain control module (PCM). The PCM sends a message through the SCP communication network to the REM indicating the transmission is in REVERSE. The REM processes this information and outputs the command to the reversing lamps which are hard-wired to the REM. Fault management of the reversing lamps will provide limited reversing lamp functionality. In the event of missing or invalid transmission data, the reversing lamps remain in the last state of operation prior to the failure for one key cycle. In the event of invalid or missing data for the ignition switch, the lamps will work in relation to PRNDL messages.

Daytime Running Lamps (DRL)

NOTE: DRL feature is available for Canadian vehicles only.

If the front electronic module (FEM) is configured for DRL, this feature illuminates the high beam headlamps, pulse width modulated (PWM), at a 40% duty cycle when the following conditions exist:

- the ignition switch is in the ON position.
- the headlamp switch is in the OFF or PARK position.
- the autolamps feature has not illuminated the exterior lamps.

Diagnostic Trouble Code (DTC) Chart

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B1470	Lamp Headlamp Input Circuit Failure	GO to Pinpoint Test E .
B1567	Lamp Headlamp High-Beam Circuit Failure	GO to Pinpoint Test B .
B1875	Turn Signal/Hazard Switch Signal Circuit Failure	GO to Pinpoint Test S .
B2472	Fog Lamp Switch Failure	GO to Pinpoint Test X .
All other DTCs	—	REFER to Section 419-10 .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B1499	Lamp Turn Signal Left Circuit Failure	If inoperative, GO to Pinpoint Test Q . If always on, GO to Pinpoint Test R .
B1501	Lamp Turn Signal Left Circuit Short to Battery	GO to Pinpoint Test Q .
B1503	Lamp Turn Signal Right Circuit Failure	If inoperative, GO to Pinpoint Test Q . If always on, GO to Pinpoint Test R .
B1505	Lamp Turn Signal Right Circuit Short to Battery	GO to Pinpoint Test Q .
B1567	Lamp Headlamp High-Beam Circuit Failure	If high beam is inoperative, GO to Pinpoint Test D . If high beam is always on, GO to Pinpoint Test E .
B1794	Lamp Headlamp Low-Beam Circuit Failure	If low beam is inoperative, GO to Pinpoint Test C . If low beam is always on, GO to Pinpoint Test E .
All other DTCs	—	REFER to Section 419-10 .

Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B1483	Brake Pedal Input Circuit Failure	GO to Pinpoint Test O .
B1499	Lamp Turn Signal Left Circuit Failure	If inoperative, GO to Pinpoint Test Q . If always on, GO to Pinpoint Test R .
B1501	Lamp Turn Signal Left Circuit Short to Battery	GO to Pinpoint Test Q .
B1503	Lamp Turn Signal Right Circuit Failure	If inoperative, GO to Pinpoint Test Q . If always on, GO to Pinpoint Test R .
B1505	Lamp Turn Signal Right Circuit Short to Battery	GO to Pinpoint Test Q .
All other DTCs	—	REFER to Section 419-10 .

Headlamps

Refer to Wiring Diagrams Cell 87 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch	• Central junction box (CJB) fuse(s): ♦ 9 (15A) (RH low beam) ♦ 11 (10A) (LH high beam) ♦ 20 (10A) (front electronic module [FEM] and instrument cluster) ♦ 23 (10A) (RH high beam) ♦ 25 (15A) (LH low beam) • Battery junction box (BJB) fuse(s): ♦ 23 (30A) (SSP4) ♦ 24 (30A) (SSP3) ♦ 27 (30A) (SSP1) ♦ 32 (30A) (SSP2) • Circuitry • FEM • Instrument cluster • Halogen bulbs

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP+, SCP-, ISO or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for FEM, refer to Section 419-10 .
    - No response/not equipped for instrument cluster, refer to Section 413-01 .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the FEM or the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index or the Instrument Cluster Diagnostic Trouble Code (DTC) Index to continue diagnostics.

8. If multiple symptoms exist, check the Switched System Power (SSP) Relay Index before proceeding to the next step. Refer to Headlamps in this section.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Switched System Power (SSP) Relay Index

Relay	Fuse	Controlled System(s)
SSP1	BJB fuse 27 (30A)	• LH high beam headlamp (FEM) • RH high intensity discharge (HID) relay (if equipped) (FEM) • RH low beam headlamp • LH front parking/turn marker lamp (FEM) • RH front parking/turn marker lamp (FEM) • RH side marker lamps (FEM) • LH side marker lamps (FEM) • Driver power door lock (FEM) • Driver power mirror
SSP2	BJB fuse 32 (30A)	• RH high beam headlamp (FEM) • LH HID relay (if equipped) (FEM) • LH low beam headlamp (FEM) • Interior courtesy/demand lighting • Windshield wiper washer pump • Switch illumination backlighting
SSP3	BJB fuse 24 (30A)	• High mounted stoplamp (rear electronic module [REM])

		• RH stop/parking lamp (REM) • Reversing lamps (REM) • LH rear turn signal (REM) • Passenger power mirror
SSP4	BJB fuse 23 (30A)	• LH stop/parking lamp (REM) • RH rear turn signal (REM) • License plate lamps • Passenger door/side locks (REM) • Luggage compartment lid release solenoid/switch • Fuel door release solenoid/switch • Luggage compartment lamp

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: Both Headlamps Are Inoperative

Normal Operation

The instrument cluster monitors the headlamp switch position by sending out voltage reference signals to the headlamp switch. If a problem is detected with circuit 8-LE21 (WH/GN) (low beam signal), circuit 10-LE21 (GY/OG) (headlamps off signal) or circuit 9-LE29 (BN/GN) (the signal return) from the headlamp switch, the instrument cluster defaults the headlamps and parking lamps on. When the headlamp switch is in the HEADLAMPS ON position, the instrument cluster sends a bussed message signal to the front electronic module (FEM) to illuminate the headlamps.

Possible Causes
- Headlamp switch
- FEM
- Instrument cluster

PINPOINT TEST A: BOTH HEADLAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
A1 CHECK THE HEADLAMP SWITCH OUTPUT	
• Ignition ON. • Monitor the instrument cluster headlamp switch status PID while placing the headlamp switch in the HEADLAMPS ON position. • **Does the PID match the headlamp switch position?**	**Yes** GO to A4 . **No** GO to A2 .

A2 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to A3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. TEST the system for normal operation.
A3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
A4 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The High Beams Are Inoperative

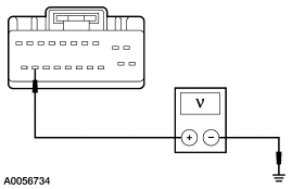
Normal Operation

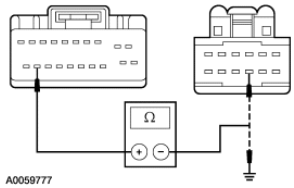
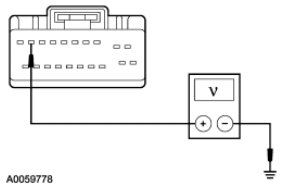
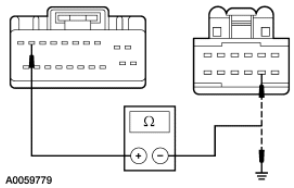
The instrument cluster monitors the multifunction switch positions. The instrument cluster sends out a voltage reference signal to the multifunction switch through circuit 8-LE14 (WH/BU). The return signal is sent through circuit 9-LG43 (BN/WH). When the multifunction switch is in the HIGH BEAM position, the instrument cluster sends a signal to the front electronic module (FEM) to illuminate the high beams. If a problem is detected with the circuits to the multifunction switch, the instrument cluster will not send a signal to the FEM to illuminate the high beams.

Possible Causes

- Circuit 8-LE14 (WH/BU) open, short to ground or voltage
- Circuit 9-LG43 (BN/WH) open, short to ground or voltage
- Multifunction switch
- FEM
- Instrument cluster

PINPOINT TEST B: THE HIGH BEAMS ARE INOPERATIVE

Test Step	Result / Action to Take
B1 MONITOR THE INSTRUMENT CLUSTER HIGH BEAM INPUT STATUS PID	
• Ignition ON. • Monitor the instrument cluster high beam input status PID while moving the multifunction switch from the LOW BEAM position to the HIGH BEAM position. • **Does the PID agree with the positions of the multifunction switch?**	**Yes** GO to B8 . **No** GO to B2 .
B2 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the multifunction switch OK?**	**Yes** GO to B3 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . CLEAR the DTCs. REPEAT the self-test.
B3 CHECK CIRCUIT 8-LE14 (WH/BU) FOR A SHORT TO VOLTAGE	
• Disconnect: Instrument Cluster C220b. • Ignition ON. • Measure the voltage between the instrument cluster C220b-19, circuit 8-LE14 (WH/BU), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B4 .
B4 CHECK CIRCUIT 8-LE14 (WH/BU) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the instrument cluster C220b-19, circuit 8-LE14 (WH/BU), harness side and ground; and between the instrument cluster C220b-19, circuit 8-LE14 (WH/BU), harness side and the multifunction switch C202-9, circuit 8-LE14 (WH/BU), harness side.	**Yes** GO to B5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 A0059777 • **Is the resistance greater than 10,000 ohms between the instrument cluster and ground, and less than 5 ohms between the instrument cluster and the multifunction switch?**	
B5 CHECK CIRCUIT 9-LG43 (BN/WH) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the instrument cluster C220b-9, circuit 9-LG43 (BN/WH), harness side and ground.  A0059778 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B6 .
B6 CHECK CIRCUIT 9-LG43 (BN/WH) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the instrument cluster C220b-9, circuit 9-LG43 (BN/WH), harness side and ground; and between the instrument cluster C220b-9, circuit 9-LG43 (BN/WH), harness side and the multifunction switch C202-8, circuit 9-LG43 (BN/WH), harness side.  A0059779 • **Is the resistance greater than 10,000 ohms between the instrument cluster and ground, and less than 5 ohms between the instrument cluster and multifunction switch?**	**Yes** GO to B7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B7 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
B8 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: One Low Beam Headlamp Is Inoperative

Normal Operation — Halogen Headlamps

The LH low beam receives voltage through circuit 29S-LE16 (OG/GN). Ground for the LH low beam is provided through circuit 31S-LE16 (BK/RD). The RH low beam receives voltage through circuit 29S-LE23 (OG/WH). Ground for the RH low beam is provided through circuit 31S-LE23 (BK/WH). The front electronic module (FEM) controls the ground for both low beam headlamps.

Normal Operation — High Intensity Discharge (HID) Headlamps

The LH HID relay coil receives voltage through circuit 29S-LE16 (OG/GN) from the central junction box (CJB). Ground for the LH HID relay coil is provided through circuit 91S-LE16 (BN/YE) and is controlled by the FEM. Battery voltage is supplied to the LH HID relay through circuit 29S-LE31 (OG/YE). When the relay is energized, voltage is switched to the LH ballast through circuit 30S-LE16 (RD/BK). Circuit 31-LE16 (BK/RD) supplies ground to the LH ballast. The RH HID relay coil receives voltage through circuit 29S-LE23 (OG/WH). Ground for the RH HID relay coil is provided through circuit 91S-LE23 (BN/WH) and is controlled by the FEM. Battery voltage is supplied to the RH HID relay through circuit 29S-LE30 (OG/BU). When the relay is energized, voltage is switched to the RH ballast through circuit 30S-LE23 (RD/WH). Circuit 31-LE23 (BK/WH) supplies ground to the RH ballast. The FEM controls the ground for both HID relay coils. The ballasts provide the necessary voltage to illuminate the HID bulbs. The ballast and HID bulb are replaced as an assembly.

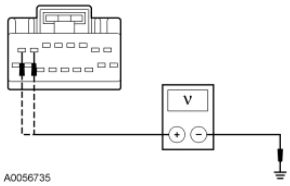
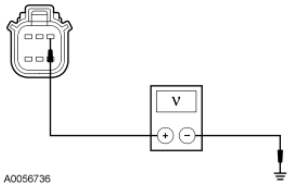
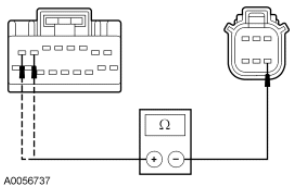
Possible Causes

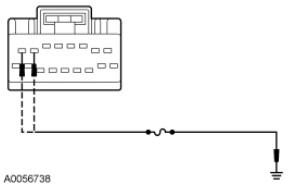
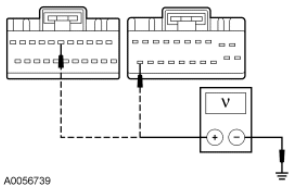
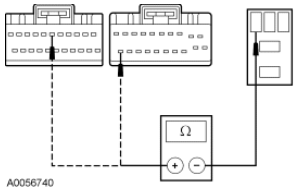
- Fuse
- Circuit 29S-LE16 (OG/GN) open
- Circuit 29S-LE23 (OG/WH) open
- Circuit 31S-LE16 (BK/RD) open or short to voltage
- Circuit 31S-LE23 (BK/WH) open or short to voltage

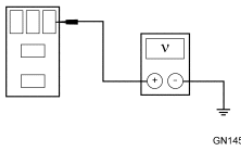
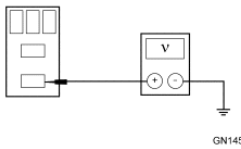
- Circuit 91S-LE16 (BN/YE) open or short to voltage
- Circuit 91S-LE23 (BN/WH) open or short to voltage
- Circuit 29S-LE31 (OG/YE) open
- Circuit 29S-LE30 (OG/BU) open
- Circuit 30S-LE16 (RD/BK) open
- Circuit 30S-LE23 (RD/WH) open
- Circuit 31-LE16 (BK/RD) open
- Circuit 31-LE23 (BK/WH) open
- HID relay
- Ballast
- FEM

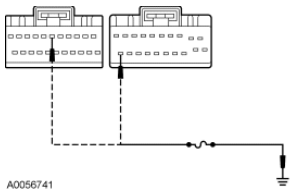
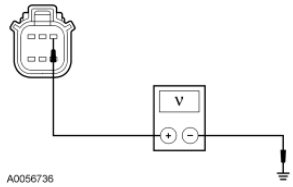
PINPOINT TEST C: ONE LOW BEAM HEADLAMP IS INOPERATIVE

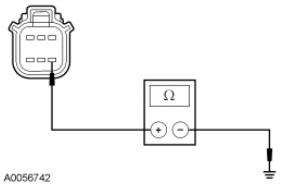
Test Step	Result / Action to Take
C1 DETERMINE IF THE VEHICLE IS EQUIPPED WITH HID LIGHTING	
• Check the vehicle for HID headlamps. • **Is the vehicle equipped with HID headlamps?**	**Yes** GO to C7 . **No** GO to C2 .
C2 RETRIEVE THE FEM DIAGNOSTIC TROUBLE CODES (DTCs)	
NOTE: Make sure the headlamp switch is in the OFF position. • Ignition ON. • Carry out the FEM on-demand self-test. • **Are any DTCs present?**	**Yes** For DTC B1794, GO to C4 . For all others, REFER to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index for correct diagnostics. **No** GO to C3 .
C3 CHECK CIRCUIT 31S-LE16 (BK/RD) (LH LOW BEAM) OR CIRCUIT 31S-LE23 (BK/WH) (RH LOW BEAM) FOR SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: FEM C201a. • Disconnect: LH Headlamp C1021 or RH Headlamp C1041. • Ignition ON. • Measure the voltage between the FEM C201a-8, circuit 31S-LE16 (BK/RD) (LH headlamp), harness side and ground; or between the FEM C201a-7, circuit 31S-LE23 (BK/WH) (RH headlamp), harness side and ground.	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to C13 .

 A0056735 • **Is any voltage present?**	
C4 CHECK CIRCUIT 29S-LE16 (OG/GN) (LH LOW BEAM) OR CIRCUIT 29S-LE23 (OG/WH) (RH LOW BEAM) FOR AN OPEN (HALOGEN HEADLAMP)	
• Ignition OFF. • Disconnect: LH Headlamp C1021 or RH Headlamp C1041. • Ignition ON. • Measure the voltage between the LH headlamp C1021-1, circuit 29S-LE16 (OG/GN), harness side and ground; or between the RH headlamp C1041-1, circuit 29S-LE23 (OG/WH), harness side and ground.  A0056736 • **Is the voltage greater than 10 volts?**	**Yes** GO to C5 . **No** VERIFY the CJB fuse 9 (15A) or fuse 25 (15A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK CIRCUIT 31S-LE16 (BK/RD) (LH LOW BEAM) OR CIRCUIT 31S-LE23 (BK/WH) (RH LOW BEAM) FOR AN OPEN	
• Ignition OFF. • Disconnect: FEM C201a. • Measure the resistance between the FEM C201a-8, circuit 31S-LE16 (BK/RD), harness side and the LH headlamp C1021-4, circuit 31S-LE16 (BK/RD), harness side; or between the FEM C201a-7, circuit 31S-LE23 (BK/WH), harness side and the RH headlamp C1041-4, circuit 31S-LE23 (BK/WH), harness side.  A0056737 • **Is the resistance less than 5 ohms?**	**Yes** GO to C6 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
C6 CHECK THE HEADLAMP ASSEMBLY	
• Connect: LH Headlamp C1021 or RH Headlamp C1041. • Connect a fused (10A) jumper wire between the FEM C201a-8, circuit 31S-LE16 (BK/RD) (LH headlamp), harness side and ground; or between the FEM C201a-7, circuit 31S-LE23 (BK/WH) (RH headlamp), harness side and ground.	**Yes** GO to C13 . **No** REPAIR or INSTALL a new headlamp assembly.

 A0056738 • Ignition ON. • **Does the inoperative low beam now illuminate?**	REFER to Headlamp Assembly in this section. CLEAR the DTCs. REPEAT the self-test.
C7 CHECK CIRCUIT 91S-LE16 (BN/YE) (LH LOW BEAM) OR CIRCUIT 91S-LE23 (BN/WH) (RH LOW BEAM) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: FEM C201b or C201f. • Disconnect: LH HID Relay C1379 or RH HID Relay C1380. • Ignition ON. • Measure the voltage between the FEM C201b-6, circuit 91S-LE16 (BN/YE) (LH headlamp), harness side and ground; or between the FEM C201f-20, circuit 91S-LE23 (BN/WH) (RH headlamp), harness side and ground.  A0056739 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to C8 .
C8 CHECK CIRCUIT 91S-LE16 (BN/YE) (LH LOW BEAM) OR CIRCUIT 91S-LE23 (BN/WH) (RH LOW BEAM) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the FEM C201b-6, circuit 91S-LE16 (BN/YE), harness side and the LH HID relay C1379-2, circuit 91S-LE16 (BN/YE), harness side; or between the FEM C201f-20, circuit 91S-LE23 (BN/WH), harness side and the RH HID relay C1380-2, circuit 91S-LE23 (BN/WH), harness side.  A0056740 • **Is the resistance less than 5 ohms?**	**Yes** GO to C9 . **No** REPAIR the circuit in question. TEST the system for normal operation.
C9 CHECK CIRCUIT 29S-LE16 (OG/GN) (LH LOW BEAM) OR CIRCUIT 29S-LE23 (OG/WH) (RH LOW BEAM) FOR AN OPEN (HID HEADLAMP)	

• Ignition ON. • Measure the voltage between the LH HID relay C1379-1, circuit 29S-LE16 (OG/GN), harness side and ground; or between the RH HID relay C1380-1, circuit 29S-LE23 (OG/WH), harness side and ground.  GN1458-A • **Is the voltage greater than 10 volts?**	**Yes** GO to C10 . **No** VERIFY the CJB fuse 9 (15A) or fuse 25 (15A) is OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.
C10 CHECK THE HID RELAY	
• Carry out the HID relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the HID relay OK?**	**Yes** GO to C11 . **No** INSTALL a new HID relay. TEST the system for normal operation.
C11 CHECK CIRCUIT 29S-LE31 (OG/YE) (LH LOW BEAM) OR CIRCUIT 29S-LE30 (OG/BU) (RH LOW BEAM) FOR AN OPEN (HID HEADLAMP)	
• Ignition OFF. • Measure the voltage between the LH HID relay C1379-3, circuit 29S-LE31 (OG/YE), harness side and ground; or between the RH HID relay C1380-3, circuit 29S-LE30 (OG/BU), harness side and ground.  GN1456-A • **Is the voltage greater than 10 volts?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to C12 .
C12 CHECK THE FEM	
• Connect: LH HID Relay C1379 or RH HID Relay C1380. • Connect a fused (10A) jumper wire between the FEM C201b-6, circuit 91S-LE16 (BN/YE) (LH headlamp), harness side and ground; or between the FEM C201f-20, circuit 91S-LE23 (BN/WH) (RH headlamp), harness side and ground.	**Yes** REMOVE the jumper wire. GO to C13 . **No** REMOVE the jumper wire. GO to C14 .

 A0056741 • Ignition ON. • **Does the inoperative low beam now illuminate?**	
C13 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
C14 CHECK CIRCUIT 30S-LE16 (RD/BK) (LH LOW BEAM) OR CIRCUIT 30S-LE23 (RD/WH) (RH LOW BEAM) FOR AN OPEN	
• Ignition OFF. • Connect: FEM C201a. • Disconnect: LH Headlamp C1021 or RH Headlamp C1041. • Place the headlamp switch in the HEADLAMPS ON position. • Measure the voltage between the LH headlamp C1021-1, circuit 30S-LE16 (RD/BK), harness side and ground; or between the RH headlamp C1041-1, circuit 30S-LE23 (RD/WH), harness side and ground.  A0056736 • **Is the voltage greater than 10 volts?**	**Yes** GO to C15 . **No** REPAIR the circuit in question. TEST the system for normal operation.
C15 CHECK CIRCUIT 31-LE16 (BK/RD) (LH LOW BEAM) OR CIRCUIT 31-LE23 (BK/WH) (RH LOW BEAM) FOR AN OPEN	
• Place the headlamp switch in the OFF position. • Measure the resistance between the LH headlamp C1021-4, circuit 31-LE16 (BK/RD), harness side and ground; or between the RH headlamp C1041-4, circuit 31-LE23 (BK/WH), harness side and ground.	**Yes** INSTALL a new ballast. REFER to Ballast in this section. TEST the system for normal operation. **No** REPAIR the circuit in

 • **Is the resistance less than 5 ohms?**	question. TEST the system for normal operation.

Pinpoint Test D: One High Beam Headlamp Is Inoperative

Normal Operation

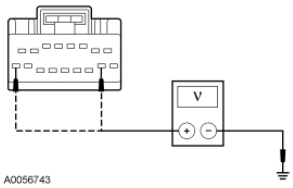
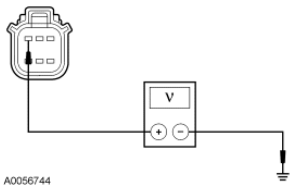
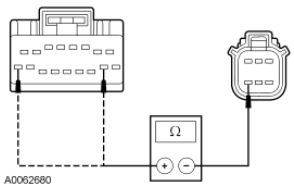
The central junction box (CJB) supplies voltage to the high beams. The LH high beam receives voltage through circuit 29S-LE15 (OG/BK). Ground for the LH high beam is provided through circuit 31S-LE15 (BK/GN). The RH high beam receives voltage through circuit 29S-LE22 (OG/GN). Ground for the RH high beam is provided through circuit 31S-LE22 (BK/RD). The front electronic module (FEM) controls the ground for both high beam headlamps.

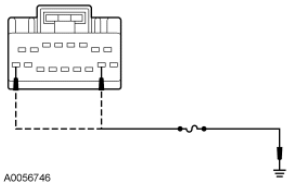
Possible Causes

- Fuse
- Circuit 29S-LE15 (OG/BK) (LH headlamp) open
- Circuit 29S-LE22 (OG/GN) (RH headlamp) open
- Circuit 31S-LE15 (BK/GN) (LH headlamp) open or short to voltage
- Circuit 31S-LE22 (BK/RD) (RH headlamp) open or short to voltage
- FEM

PINPOINT TEST D: ONE HIGH BEAM HEADLAMP IS INOPERATIVE

Test Step	Result / Action to Take
D1 RETRIEVE THE FEM DIAGNOSTIC TROUBLE CODES (DTCs)	
NOTE: Make sure the headlamp switch is in the OFF position. • Ignition ON. • Carry out the FEM on-demand self-test. • **Are any DTCs present?**	**Yes** For DTC B1567, GO to D3 . For all others, REFER to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index for correct diagnostics. **No** GO to D2 .
D2 CHECK CIRCUIT 31S-LE15 (BK/GN) OR CIRCUIT 31S-LE22 (BK/RD) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: FEM C201a. • Disconnect: LH Headlamp C1021 or RH Headlamp C1041. • Ignition ON. • Measure the voltage between the FEM C201a-17, circuit 31S-LE15 (BK/GN) (LH headlamp), harness side and	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to D6 .

ground; or between the FEM C201a-10, circuit 31S-LE22 (BK/RD) (RH headlamp), harness side and ground.  • **Is any voltage present?**	
D3 CHECK CIRCUIT 29S-LE15 (OG/BK) OR CIRCUIT 29S-LE22 (OG/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: LH Headlamp C1021 or RH Headlamp C1041. • Ignition ON. • Measure the voltage between the LH headlamp C1021-3, circuit 29S-LE15 (OG/BK), harness side and ground; or between the RH headlamp C1041-3, circuit 29S-LE22 (OG/GN), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to D4 . **No** VERIFY the CJB fuse 11 (10A) or fuse 23 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK CIRCUIT 31S-LE15 (BK/GN) OR CIRCUIT 31S-LE22 (BK/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: FEM C201c. • Measure the resistance between the LH headlamp C1021-6, circuit 31S-LE15 (BK/GN), harness side and the FEM C201a-17, circuit 31S-LE15 (BK/GN), harness side; or the RH headlamp C1041-6, circuit 31S-LE22 (BK/RD), harness side and the FEM C201a-10, circuit 31S-LE22 (BK/RD), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to D5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D5 CHECK THE HEADLAMP ASSEMBLY	

• Ignition OFF. • Connect: LH Headlamp C1021 or RH Headlamp C1041. • Ignition ON. • Connect a fused (10A) jumper wire between the FEM C201a-17, circuit 31S-LE15 (BK/GN), harness side and ground; or between the FEM C201a-10, circuit 31S-LE22 (BK/RD), harness side and ground.  • **Does the inoperative headlamp now illuminate?**	**Yes** REMOVE the jumper wire. GO to D6 . **No** REMOVE the jumper wire. REPAIR or INSTALL a new headlamp assembly. REFER to Headlamp Assembly in this section. CLEAR the DTCs. REPEAT the self-test.
D6 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Headlamps Are On Continuously

Normal Operation

The instrument cluster monitors the headlamp switch position. When the headlamp switch is in the HEADLAMPS ON position, the instrument cluster sends a message to the front electronic module (FEM) to illuminate the headlamps. If a problem is detected with the circuits to the headlamp switch, the instrument cluster defaults the headlamps on. The FEM controls the ground circuit for each halogen bulb or high intensity discharge (HID) relay (if equipped). If a problem is detected with any of the signal circuits to the headlamp switch, the instrument cluster defaults the parking lamps and headlamps on. The FEM controls the ground for the headlamp bulbs (and the HID relays, if equipped).

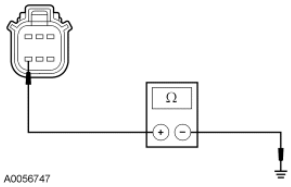
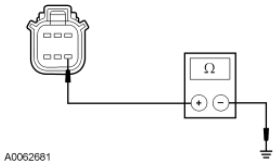
Possible Causes

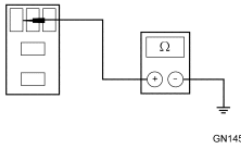
- Circuit 31S-LE16 (BK/RD) (LH halogen low beam) short to ground
- Circuit 31S-LE23 (BK/WH) (RH halogen low beam) short to ground
- Circuit 91S-LE16 (BN/YE) (LH HID relay) short to ground
- Circuit 91S-LE23 (BN/WH) (RH HID relay) short to ground
- Circuit 31S-LE15 (BK/GN) (LH halogen high beam) short to ground
- Circuit 31S-LE22 (BK/RD) (RH halogen high beam) short to ground
- Circuit 8-LE21 (WH/GN) open, short to voltage or ground
- Circuit 8-LF14 (WH/BU) open, short to voltage or ground
- Circuit 9-LE29 (BN/GN) open or short to voltage
- Circuit 10-LE21 (GY/OG) open, short to voltage or ground
- Circuit 10-LE47 (GY/OG) short to ground

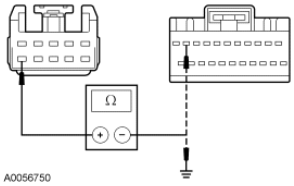
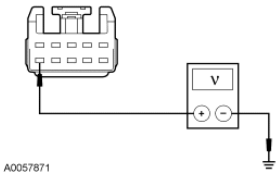
- HID relay
- Headlamp switch
- Instrument cluster
- FEM
- Headlamp assembly
- Multifunction switch

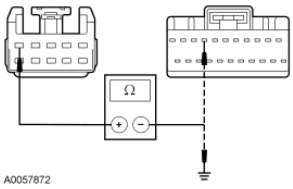
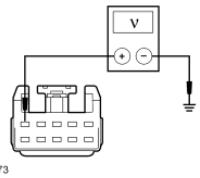
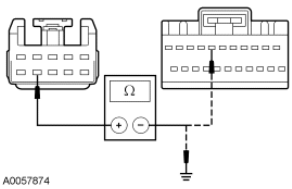
PINPOINT TEST E: THE HEADLAMPS ARE ON CONTINUOUSLY

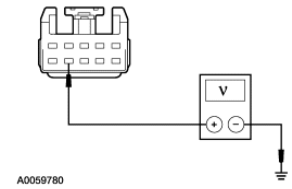
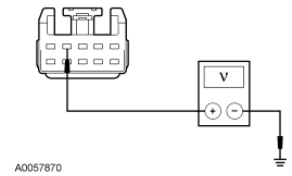
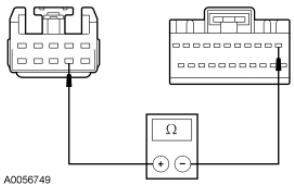
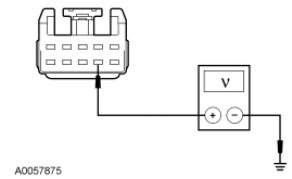
Test Step	Result / Action to Take
E1 DETERMINE THE ALWAYS ON HEADLAMP(S)	
NOTE: Make sure the multifunction switch is in the LOW BEAM position. • Ignition ON. • Place the headlamp switch in the OFF position. • Observe the headlamps. • **Is only one lamp illuminated?**	**Yes** GO to E2 . **No** GO to E10 .
E2 RETRIEVE THE FEM DIAGNOSTIC TROUBLE CODES (DTCs)	
• Carry out the FEM on-demand self-test. • **Are any DTCs present?**	**Yes** For DTC B1567, GO to E3 . For DTC B1794, GO to E5 . For all others, REFER to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index for correct diagnostics. **No** If not equipped with HID headlamps, GO to E24 . If equipped with HID headlamps, GO to E7 .
E3 CHECK THE FEM (HIGH BEAM)	
• Ignition OFF. • Disconnect: FEM C201a. • **Does the LH or RH high beam continue to illuminate?**	**Yes** GO to E4 . **No** GO to E24 .
E4 CHECK CIRCUIT 31S-LE15 (BK/GN) OR CIRCUIT 31S-LE22 (BK/RD) FOR A SHORT TO GROUND	

• Disconnect: LH Headlamp C1021 or RH Headlamp C1041. • Measure the resistance between the LH headlamp C1021-6, circuit 31S-LE15 (BK/GN), harness side and ground; or between the RH headlamp C1041-6, circuit 31S-LE22 (BK/RD), harness side and ground.  A0056747 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR or INSTALL a new headlamp assembly. REFER to Headlamp Assembly in this section. CLEAR the DTCs. REPEAT the self-test.
E5 CHECK THE FEM (HALOGEN LOW BEAM)	
• Ignition OFF. • Disconnect: FEM C201a. • **Does the LH or RH low beam continue to illuminate?**	**Yes** GO to E6 . **No** GO to E24 .
E6 CHECK CIRCUIT 31S-LE16 (BK/RD) OR CIRCUIT 31S-LE23 (BK/WH) FOR A SHORT TO GROUND	
• Disconnect: LH Headlamp C1021 or RH Headlamp C1041. • Measure the resistance between the LH headlamp C1021-4, circuit 31S-LE16 (BK/RD), harness side and ground; or between the RH headlamp C1041-4, circuit 31S-LE23 (BK/WH), harness side and ground.  A0062681 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR or INSTALL a new headlamp assembly. REFER to Headlamp Assembly in this section. CLEAR the DTCs. REPEAT the self-test.
E7 CHECK THE FEM (HID LOW BEAM)	
• Ignition OFF. • Disconnect: FEM C201a. • **Does the LH or RH low beam continue to illuminate?**	**Yes** GO to E8 . **No** GO to E24 .
E8 CHECK CIRCUIT 91S-LE16 (BN/YE) OR CIRCUIT 91S-LE23 (BN/WH) FOR A SHORT TO GROUND	
• Disconnect: LH HID Relay C1379 or RH HID Relay C1380. • Measure the resistance between the LH HID relay C1379-2, circuit 91S-LE16 (BN/YE), harness side and ground; or between the RH HID relay C1380-2, circuit 91S-LE23 (BN/WH), harness side and ground	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to E9 .

 GN1455-A • **Is the resistance less than 5 ohms?**	
E9 CHECK THE HID RELAY	
• Carry out the HID relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the HID relay OK?**	**Yes** REPAIR circuit 30S-LE16 (RD/BK) (LH headlamp) or circuit 30S-LE23 (RD/WH) (RH headlamp). TEST the system for normal operation. **No** INSTALL a new HID relay. TEST the system for normal operation.
E10 DETERMINE IF THE LOW BEAMS OR HIGH BEAMS ARE ILLUMINATED	
• Ignition OFF. • Observe the headlamps. • **Are the high beam headlamps illuminated?**	**Yes** GO to E11 . **No** GO to E12 .
E11 MONITOR THE HIGH BEAM STATUS	
• Ignition ON. • Monitor the instrument cluster high beam input status PID while moving the multifunction switch from the LOW BEAM to HIGH BEAM positions. • **Does the PID agree with the positions of the multifunction switch?**	**Yes** GO to E24 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
E12 MONITOR THE HEADLAMP SWITCH STATUS	
• Ignition ON. • Monitor the instrument cluster headlamp switch status PID while placing the headlamp switch in the HEADLAMPS ON and then OFF positions. • **Does the PID agree with the positions of the headlamp switch?**	**Yes** GO to E24 . **No** GO to E13 .
E13 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing.	**Yes** GO to E14 . **No** INSTALL a new headlamp switch. REFER to Headlamp

• **Is the headlamp switch OK?**	Switch in this section. TEST the system for normal operation.
E14 CHECK CIRCUIT 8-LE21 (WH/GN) FOR AN OPEN OR SHORT TO GROUND	
• Disconnect: Instrument Cluster C220c. • Measure the resistance between the headlamp switch C205-10, circuit 8-LE21 (WH/GN), harness side and the instrument cluster C220c-10, circuit 8-LE21 (WH/GN), harness side; and between the headlamp switch C205-10, circuit 8-LE21 (WH/GN), harness side and ground.  A0056750 • **Is the resistance less than 5 ohms between the headlamp switch and the instrument cluster, and greater than 10,000 ohms between the headlamp switch and ground?**	**Yes** GO to E15 . **No** REPAIR the circuit. TEST the system for normal operation.
E15 CHECK CIRCUIT 8-LE21 (WH/GN) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the headlamp switch C205-10, circuit 8-LE21 (WH/GN), harness side and ground.  A0057871 • **Is the any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to E16 .
E16 CHECK CIRCUIT 8-LF14 (WH/BU) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the headlamp switch C205-5, circuit 8-LF14 (WH/BU), harness side and the instrument cluster C220c-8, circuit 8-LF14 (WH/BU), harness side; and between the headlamp switch C205-5, circuit 8-LF14 (WH/BU), harness side and ground.	**Yes** GO to E17 . **No** REPAIR the circuit. TEST the system for normal operation.

 A0057872 • **Is the resistance less than 5 ohms between the headlamp switch and the instrument cluster, and greater than 10,000 ohms between the headlamp switch and ground?**	
E17 CHECK CIRCUIT 8-LF14 (WH/BU) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the headlamp switch C205-5, circuit 8-LF14 (WH/BU), harness side and ground.  A0057873 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to E18 .
E18 CHECK CIRCUIT 10-LE21 (GY/OG) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the headlamp switch C205-9, circuit 10-LE21 (GY/OG), harness side and the instrument cluster C220c-7, circuit 10-LE21 (GY/OG), harness side; and between the headlamp switch C205-9, circuit 10-LE21 (GY/OG), harness side and ground.  A0057874 • **Is the resistance less than 5 ohms between the headlamp switch and the instrument cluster, and greater than 10,000 ohms between the headlamp switch and ground?**	**Yes** GO to E19 . **No** REPAIR the circuit. TEST the system for normal operation.
E19 CHECK CIRCUIT 10-LE21 (GY/OG) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the headlamp switch C205-9, circuit 10-LE21 (GY/OG), harness side and ground.	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to E20 .

 A0059780 • **Is any voltage present?**	
E20 CHECK CIRCUIT 10-LE47 (GY/OG) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the headlamp switch C205-4, circuit 10-LE47 (GY/OG), harness side and ground.  A0057870 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to E21 .
E21 CHECK CIRCUIT 9-LE29 (BN/GN) FOR AN OPEN	
• Measure the resistance between the headlamp switch C205-7, circuit 9-LE29 (BN/GN), harness side and the instrument cluster C220c-1, circuit 9-LE29 (BN/GN), harness side.  A0056749 • **Is the resistance less than 5 ohms?**	**Yes** GO to E22 . **No** REPAIR the circuit. TEST the system for normal operation.
E22 CHECK CIRCUIT 9-LE29 (BN/GN) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the headlamp switch C205-7, circuit 9-LE29 (BN/GN), harness side ground.  A0057875 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to E23 .
E23 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
E24 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Power Supply Relay Is Inoperative — All Switched System Power (SSP) Features

Normal Operation

Battery voltage is supplied to the SSP relays through the battery junction box (BJB). Ground for the SSP relay coils is controlled by the front electronic module (FEM) and the rear electronic module (REM) through the following circuits: 31S-DG51 (BK/YE), 31S-DG55 (BK/RD), 31S-DG57 (BK/YE), 31S-DG53 (BK/OG), 31S-DK21 (BK/WH) and 31S-DK30 (BK/OG). All of these circuits are spliced together so that either the FEM or the REM can ground this circuit and energize the SSP relays.

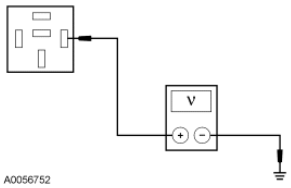
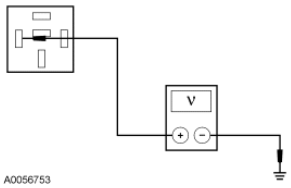
Possible Causes

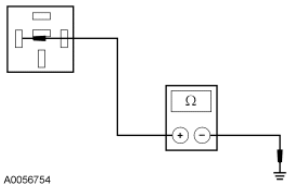
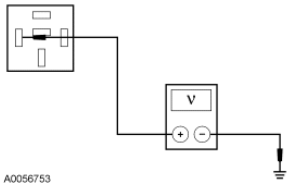
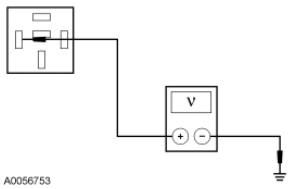
- Fuse
- Circuit 31S-DG51 (BK/YE) short to voltage
- Circuit 31S-DG55 (BK/RD) short to voltage
- Circuit 31S-DG57 (BK/YE) short to voltage
- Circuit 31S-DG53 (BK/OG) short to voltage
- Circuit 31S-DK21 (BK/WH) short to voltage
- Circuit 31S-DK30 (BK/OG) short to voltage
- SSP relay
- BJB
- FEM
- REM

PINPOINT TEST F: THE POWER SUPPLY RELAY IS INOPERATIVE — ALL SWITCHED SYSTEM POWER (SSP) FEATURES

NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature.

NOTE: Refer to Exterior Lighting and the Switched System Power (SSP) Relay Index for complete detail of SSP-powered features.

Test Step	Result / Action to Take
F1 CHECK THE BJB	
• Ignition OFF. • Disconnect: All SSP Relays C441. • Measure the voltage between the SSP1 relay C441-86, circuit 30-DG51 (RD/YE), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to F2 . **No** VERIFY the BJB fuse 27 (30A) is OK. If OK, REPAIR or INSTALL a new BJB. TEST the system for normal operation.
F2 CHECK THE CONTROL GROUND CIRCUIT FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the SSP1 relay C441-85, circuit 31S-DG51 (BK/YE), harness side and ground.  • **Is any voltage present?**	**Yes** GO to F4 . **No** GO to F3 .
F3 CHECK FOR GROUND ON CIRCUIT 31S-DG51 (BK/YE)	
• Measure the resistance between the SSP1 relay C441-85, circuit 31S-DG51 (BK/YE), harness side and ground.	**Yes** INSTALL a new SSP1 relay. TEST the system for normal operation. **No** REPAIR the circuit between the SSP relays and the electronic modules. TEST the system for normal operation.

 • **Is the resistance less than 5 ohms?**	
F4 CHECK THE SSP RELAY(S)	
• Carry out the relay component test on each SSP relay. Refer to Wiring Diagrams Cell 149 for component testing. • **Does each relay pass the component test?**	**Yes** GO to F5 . **No** INSTALL a new SSP relay. TEST the system for normal operation.
F5 CHECK THE FEM FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: FEM C201b. • Ignition ON. • Measure the voltage between the SSP1 relay C441-85, circuit 31S-DG51 (BK/YE), harness side and ground.  • **Is any voltage present?**	**Yes** GO to F6 . **No** GO to F7 .
F6 CHECK THE REM FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: REM C420b. • Ignition ON. • Measure the voltage between the SSP1 relay C441-85, circuit 31S-DG51 (BK/YE), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the SSP ground control circuit. TEST the system for normal operation. **No** GO to F8 .
F7 CHECK FOR CORRECT FEM OPERATION	

• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
F8 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: The Power Supply Relay Is Inoperative — Switched System Power (SSP) 1

Normal Operation

Battery voltage is supplied to the SSP1 relay through the battery junction box (BJB) fuse 27 (30A). Ground for the relay coil is controlled by the front electronic module (FEM) and the rear electronic module (REM) through circuit 31S-DG51 (BK/YE). When the SSP1 relay is energized, battery voltage is switched from the BJB to circuit 30-DD3 (RD/OG).

Possible Causes

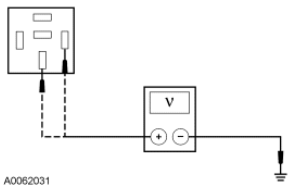
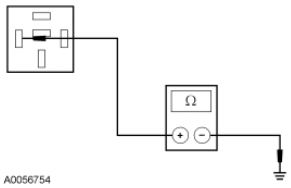
- Fuse
- Circuit 31S-DG51 (BK/YE) open
- Circuit 30-DD3 (RD/OG) open
- BJB
- SSP1 relay

PINPOINT TEST G: THE POWER SUPPLY RELAY IS INOPERATIVE — SWITCHED SYSTEM POWER (SSP) 1

NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature.

NOTE: Refer to Exterior Lighting and the Switched System Power (SSP) Relay Index for complete details of SSP1 powered features.

Test Step	Result / Action to Take
G1 CHECK THE BJB	

• Ignition OFF. • Disconnect: SSP1 Relay C441. • Measure the voltage between the SSP1 relay C441-86, circuit 30-DG51 (RD/YE), harness side and ground; and between the SSP1 relay C441-30, circuit 30-DG52 (RD/BU), harness side and ground.  • **Are the voltages greater than 10 volts?**	**Yes** GO to G2 . **No** VERIFY the BJB fuse 27 (30A) is OK. If OK, REPAIR or INSTALL a new BJB. TEST the system for normal operation.
G2 CHECK CIRCUIT 31S-DG51 (BK/YE) FOR AN OPEN	
• Ignition ON. • Measure the resistance between the SSP1 relay C441-85, circuit 31S-DG51 (BK/YE), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to G3 . **No** REPAIR the circuit. TEST the system for normal operation.
G3 CHECK THE SSP1 RELAY	
• Carry out the SSP1 relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the SSP1 relay OK?**	**Yes** REPAIR circuit 30-DD3 (RD/OG). TEST the system for normal operation. **No** INSTALL a new SSP1 relay. TEST the system for normal operation.

Pinpoint Test H: The Power Supply Relay Is Inoperative — Switched System Power (SSP) 2

Normal Operation

Battery voltage is supplied to the SSP2 relay through the battery junction box (BJB) fuse 32 (30A). Ground for the relay coil is controlled by the front electronic module (FEM) and rear electronic module (REM) through circuit 31S-DG53 (BK/OG). When the SSP2 relay is energized, battery voltage is switched from the BJB to circuit 30-DD2 (RD/BU).

Possible Causes

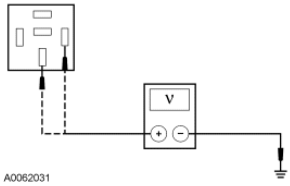
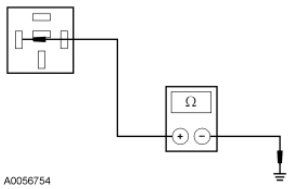
- Fuse
- Circuit 31S-DG53 (BK/OG) open

- Circuit 30-DD2 (RD/BU) open
- BJB
- SSP2 relay

PINPOINT TEST H: THE POWER SUPPLY RELAY IS INOPERATIVE — SWITCHED SYSTEM POWER (SSP) 2

NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature.

NOTE: Refer to Exterior Lighting and the Switched System Power (SSP) Relay Index for complete details of SSP2 powered features.

Test Step	Result / Action to Take
H1 CHECK THE BJB	
• Ignition OFF. • Disconnect: SSP2 Relay C442. • Measure the voltage between the SSP2 relay C442-86, circuit 30-DG53 (RD/OG), harness side and ground; and between the SSP2 relay C442-30, circuit 30-DG54 (RD/GN), harness side and ground.  A0062031 • **Are the voltages greater than 10 volts?**	**Yes** GO to H2 . **No** VERIFY the BJB fuse 32 (30A) is OK. If OK, REPAIR or INSTALL a new BJB. TEST the system for normal operation.
H2 CHECK CIRCUIT 31S-DG53 (BK/OG) FOR AN OPEN	
• Ignition ON. • Measure the resistance between the SSP2 relay C442-85, circuit 31S-DG53 (BK/OG), harness side and ground.  A0056754 • **Is the resistance less than 5 ohms?**	**Yes** GO to H3 . **No** REPAIR the circuit. TEST the system for normal operation.
H3 CHECK THE SSP2 RELAY	
• Carry out the SSP2 relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the SSP2 relay OK?**	**Yes** REPAIR circuit 30-DD2 (RD/BU). TEST the system for normal operation. **No** INSTALL a new SSP2 relay. TEST

	the system for normal operation.

Pinpoint Test I: The Power Supply Relay Is Inoperative — Switched System Power (SSP) 3

Normal Operation

Battery voltage is supplied to the SSP3 relay through the battery junction box (BJB) fuse 24 (30A). Ground for the relay coil is controlled by the front electronic module (FEM) and rear electronic module (REM) through circuit 31S-DG55 (BK/RD). When the SSP3 relay is energized, battery voltage is switched from the BJB to circuit 30S-DB15 (RD/OG).

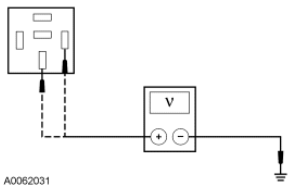
Possible Causes

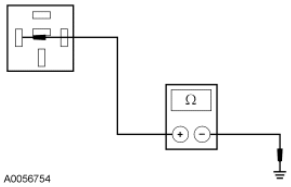
- Fuse
- Circuit 31S-DG55 (BK/RD) open
- Circuit 30S-DB15 (RD/OG) open
- BJB
- SSP3 relay

PINPOINT TEST I: THE POWER SUPPLY RELAY IS INOPERATIVE — SWITCHED SYSTEM POWER (SSP) 3

NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature.

NOTE: Refer to Exterior Lighting and the Switched System Power (SSP) Relay Index for complete details of SSP3 powered features.

Test Step	Result / Action to Take
I1 CHECK THE BJB	
• Ignition OFF. • Disconnect: SSP3 Relay C444. • Measure the voltage between the SSP3 relay C444-86, circuit 30-DG55 (RD/BK), harness side and ground; and between the SSP3 relay C444-30, circuit 30-DG56 (RD/WH), harness side and ground.  • **Are the voltages greater than 10 volts?**	**Yes** GO to I2 . **No** VERIFY the BJB fuse 24 (30A) is OK. If OK, REPAIR or INSTALL a new BJB. TEST the system for normal operation.
I2 CHECK CIRCUIT 31S-DG55 (BK/RD) FOR AN OPEN	
• Ignition ON. • Measure the resistance between the SSP3 relay C444-85, circuit 31S-DG55 (BK/RD), harness side and ground.	**Yes** GO to I3 . **No** REPAIR the circuit. TEST the system for normal operation.

 • **Is the resistance less than 5 ohms?**	
I3 CHECK THE SSP3 RELAY	
• Carry out the SSP3 relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the SSP3 relay OK?**	**Yes** REPAIR circuit 30S-DB15 (RD/OG). TEST the system for normal operation. **No** INSTALL a new SSP3 relay. TEST the system for normal operation.

Pinpoint Test J: The Power Supply Relay Is Inoperative — Switched System Power (SSP) 4

Normal Operation

Battery voltage is supplied to the SSP4 relay through the battery junction box (BJB) fuse 23 (30A). Ground for the relay coil is controlled by the front electronic module (FEM) and rear electronic module (REM) through circuit 31S-DG57 (BK/YE). When the SSP4 relay is energized, battery voltage is switched from the BJB to circuit 30S-DB16 (RD/GN).

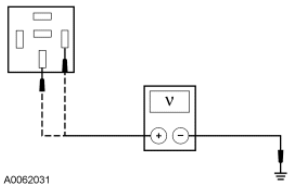
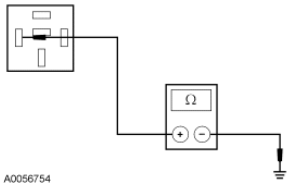
Possible Causes
- Fuse
- Circuit 31S-DG57 (BK/YE) open
- Circuit 30S-DB16 (RD/GN) open
- BJB
- SSP4 relay

PINPOINT TEST J: THE POWER SUPPLY RELAY IS INOPERATIVE — SWITCHED SYSTEM POWER (SSP) 4

NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature.

NOTE: Refer to Exterior Lighting and the Switched System Power (SSP) Relay Index for complete details of SSP4 powered features.

Test Step	Result / Action to Take
J1 CHECK THE BJB	
• Ignition OFF. • Disconnect: SSP4 Relay C445. • Measure the voltage between the SSP4 relay C445-86, circuit 30-DG57 (RD/YE), harness side and ground; and between the SSP4 relay C445-30, circuit 30-DG58	**Yes** GO to J2 . **No** VERIFY the BJB fuse 23 (30A) is OK. If OK, REPAIR or INSTALL a

(RD/BU), harness side and ground.  A0062031 • **Are the voltages greater than 10 volts?**	new BJB. TEST the system for normal operation.
J2 CHECK CIRCUIT 31S-DG57 (BK/YE) FOR AN OPEN	
• Ignition ON. • Measure the resistance between the SSP4 relay C445-85, circuit 31S-DG57 (BK/YE), harness side and ground.  A0056754 • **Is the resistance less than 5 ohms?**	**Yes** GO to J3 . **No** REPAIR the circuit. TEST the system for normal operation.
J3 CHECK THE SSP4 RELAY	
• Carry out the SSP4 relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the SSP4 relay OK?**	**Yes** REPAIR circuit 30S-DB16 (RD/GN). TEST the system for normal operation. **No** INSTALL a new SSP4 relay. TEST the system for normal operation.

Autolamps

Refer to Wiring Diagrams Cell 87 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch	• Circuitry • Light sensor • Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.
5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP+, SCP-, ISO or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for instrument cluster, refer to Section 413-01 .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

8. If multiple symptoms exist, check the Switched System Power (SSP) Relay Index before proceeding to the next step. Refer to Headlamps in this section.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test K: The Autolamps Are Inoperative

Normal Operation

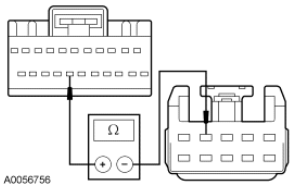
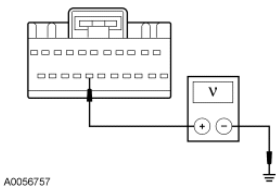
The instrument cluster monitors the autolamps on the signal circuit to the headlamp switch through circuit 10-LE47 (GY/OG). When the headlamp switch is turned to the AUTOLAMPS ON position, the signal is returned through circuit 9-LE29 (BN/GN). After the signal for the autolamps is received, the instrument cluster then monitors the ambient light conditions by sending a signal to the light sensor through circuit 8-LE42 (WH/BU). The light sensor is grounded through circuit 31-LE42 (BK/OG). If a problem is detected with any of the voltage reference signals to the headlamp switch, the instrument cluster defaults the headlamps and parking lamps on.

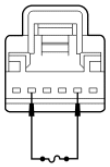
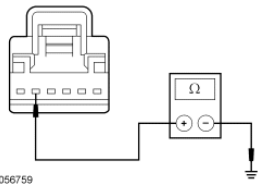
Possible Causes

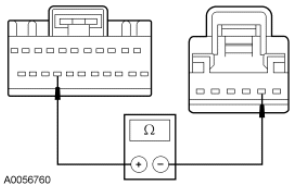
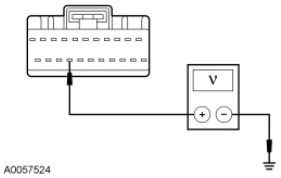
- Circuit 8-LE42 (WH/BU) open or short to voltage
- Circuit 10-LE47 (GY/OG) open or short to voltage
- Circuit 31-LE42 (BK/OG) open
- Light sensor
- Headlamp switch
- Instrument cluster

PINPOINT TEST K: THE AUTOLAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
K1 CHECK THE HEADLAMPS OPERATION	
• Place the headlamp switch in the HEADLAMPS ON position.	**Yes** GO to K2 .

• **Do the low beams illuminate?**	**No** REFER to Headlamps in this section to continue diagnostics.
K2 CHECK THE HEADLAMP SWITCH OUTPUT	
• Ignition ON. • Monitor the instrument cluster headlamp switch status PID while placing the headlamp switch in the AUTOLAMPS ON position. • **Does the PID match with the headlamp switch position?**	**Yes** GO to K6 . **No** GO to K3 .
K3 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to K4 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. TEST the system for normal operation.
K4 CHECK CIRCUIT 10-LE47 (GY/OG) FOR AN OPEN	
• Disconnect: Instrument Cluster C220c. • Measure the resistance between the instrument cluster C220c-18, circuit 10-LE47 (GY/OG), harness side and the headlamp switch C205-4, circuit 10-LE47 (GY/OG), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to K5 . **No** REPAIR the circuit. TEST the system for normal operation.
K5 CHECK CIRCUIT 10-LE47 (GY/OG) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the instrument cluster C220c-18, circuit 10-LE47 (GY/OG), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to K11 .
K6 CHECK THE LIGHT SENSOR INPUT	

• Monitor the instrument cluster light sensor status PID while covering and then illuminating the light sensor. • **Does the PID percentage change with the light sensor covered and then illuminated?**	**Yes** GO to K11 . **No** GO to K7 .
K7 CHECK THE LIGHT SENSOR	
• Ignition OFF. • Disconnect: Light Sensor C286. • Ignition ON. • Monitor the instrument cluster light sensor status PID while connecting and then disconnecting a fused (5A) jumper wire between the light sensor C286-2, circuit 8-LE42 (WH/BU), harness side and the light sensor C286-5, circuit 31-LE42 (BK/OG), harness side.  A0056758 • **Does the PID percentage change with the jumper wire connected and then disconnected?**	**Yes** INSTALL a new light sensor. REFER to Light Sensor in this section. TEST the system for normal operation. **No** GO to K8 .
K8 CHECK CIRCUIT 31-LE42 (BK/OG) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the light sensor C286-5, circuit 31-LE42 (BK/OG), harness side and ground.  A0056759 • **Is the resistance less than 5 ohms?**	**Yes** GO to K9 . **No** REPAIR the circuit. TEST the system for normal operation.
K9 CHECK CIRCUIT 8-LE42 (WH/BU) FOR AN OPEN	
• Disconnect: Instrument Cluster C220a. • Measure the resistance between the instrument cluster C220a-19, circuit 8-LE42 (WH/BU), harness side and the light sensor C286-2, circuit 8-LE42 (WH/BU), harness side.	**Yes** GO to K10 . **No** REPAIR the circuit. TEST the system for normal operation.

 • **Is the resistance less than 5 ohms?**	
K10 CHECK CIRCUIT 8-LE42 (WH/BU) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the instrument cluster C220a-19, circuit 8-LE42 (WH/BU), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to K11 .
K11 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Autolamps Are On Continuously

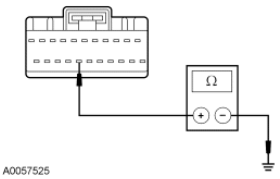
Normal Operation

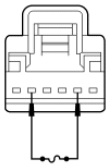
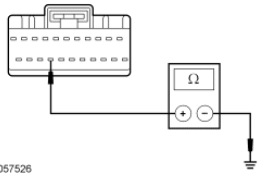
The instrument cluster monitors a signal to the headlamp switch through circuit 10-LE47 (GY/OG). When the headlamp switch is turned to the AUTOLAMPS ON position, the signal is returned through circuit 9-LE29 (BN/GN). After the signal for the autolamps is received, the instrument cluster monitors the ambient light conditions by sending a signal to the light sensor through circuit 8-LE42 (WH/BU).

Possible Causes

- Circuit 8-LE42 (WH/BU) short to ground
- Circuit 10-LE47 (GY/OG) short to ground
- Light sensor
- Headlamp switch
- Instrument cluster

PINPOINT TEST L: THE AUTOLAMPS ARE ON CONTINUOUSLY

Test Step	Result / Action to Take
L1 CHECK THE HEADLAMP SWITCH OUTPUT	
• Ignition ON. • Monitor the instrument cluster headlamp switch status PID while placing the headlamp switch in the AUTOLAMPS ON and then OFF positions. • **Does the PID match the headlamp switch position?**	**Yes** GO to L4 . **No** GO to L2 .
L2 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to L3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. TEST the system for normal operation.
L3 CHECK CIRCUIT 10-LE47 (GY/OG) FOR A SHORT TO GROUND	
• Disconnect: Instrument Cluster C220c. • Measure the resistance between the instrument cluster C220c-18, circuit 10-LE47 (GY/OG), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to L7 .
L4 CHECK THE OPERATION OF THE LIGHT SENSOR	
• Monitor the instrument cluster light sensor status PID while covering and then illuminating the light sensor. • **Does the PID percentage change with the light sensor covered and then illuminated?**	**Yes** GO to L7 . **No** GO to L5 .
L5 CHECK THE LIGHT SENSOR	
• Ignition OFF. • Disconnect: Light Sensor C286. • Ignition ON. • Monitor the instrument cluster light sensor status PID while connecting and then disconnecting a fused (5A) jumper wire between the light sensor C286-2, circuit 8-LE42 (WH/BU), harness side and the light sensor C286-5, circuit 31-LE42 (BK/OG), harness side.	**Yes** INSTALL a new light sensor. REFER to Light Sensor in this section. TEST the system for normal operation **No** GO to L6 .

 A0056758 • **Does the PID percentage change with the jumper wire connected and then disconnected?**	
L6 CHECK CIRCUIT 8-LE42 (WH/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Instrument Cluster C220a. • Measure the resistance between the instrument cluster C220a-19, circuit 8-LE42 (WH/BU), harness side and ground.  A0057526 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to L7 .
L7 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Stoplamps

Refer to Wiring Diagrams Cell 90 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Stoplamp switch	• Battery junction box (BJB) fuse(s): ♦ 3 (5A) (LH stoplamp) ♦ 7 (5A) (RH stoplamp) ♦ 8 (5A) (high mounted stoplamp) • Central junction box (CJB) fuse 35 (5A) (stoplamp switch) • Circuitry • Rear electronic module (REM) • Anti-lock brake system (ABS) module • Electric parking brake module • Bulbs

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.

- check the connections to the vehicle.
- check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP+, SCP-, ISO or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for REM, refer to Section 419-10 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the REM.

7. If the DTCs retrieved are related to the concern, go to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index.

8. If multiple symptoms exist, check the Switched System Power (SSP) Relay Index before proceeding to the next step. Refer to Headlamps in this section.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test M: The Stoplamps Are Inoperative

Normal Operation — Vehicles Without Stability Assist

The stoplamp ground circuits are independently controlled by the rear electronic module (REM). The stoplamp switch is supplied battery voltage through circuit 29-CF58 (OG/GN) from the central junction box (CJB). When the brake pedal is applied, the stoplamp switch allows voltage to flow through to circuit 29S-CF1 (OG/BU). Circuit 29S-CF1 (OG/BU) is spliced to carry the voltage to the powertrain control module (PCM) and the REM. Voltage to the REM (from the stoplamp switch) after the splice, is carried through circuit 29S-DK30 (OG). When the REM receives voltage from the stoplamp switch, the REM illuminates the stoplamps.

Normal Operation — Vehicles With Stability Assist

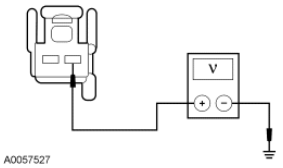
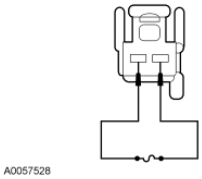
The stoplamp ground circuits are independently controlled by the REM. The stoplamp switch is supplied battery voltage through circuit 29-CF58 (OG/GN). When the brake pedal is applied, the stoplamp switch allows voltage to flow through circuit 29S-CF1 (OG/BU) to the anti-lock brake system (ABS) module. The ABS module then sends voltage through circuit 29S-CF2 (OG/BU), which is spliced to carry the voltage to the PCM and the REM. Voltage to the REM (from the ABS module) after the splice, is carried through circuit 29S-DK30 (OG). When the REM receives voltage from the ABS module, the REM illuminates the stoplamps.

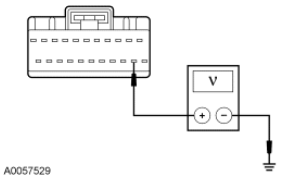
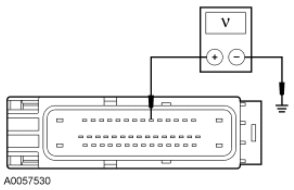
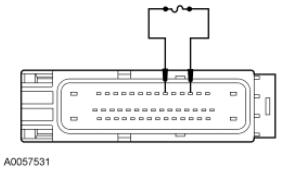
Possible Causes

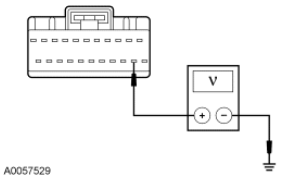
- Fuse

- Circuit 29-CF58 (OG/GN) open
- Circuit 29S-CF1 (OG/BU) open
- Circuit 29S-CF2 (OG/BU) open or short to ground
- Circuit 29S-DK30 (OG) open or short to ground
- Stoplamp switch
- REM
- ABS module

PINPOINT TEST M: THE STOPLAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
M1 CHECK THE STOPLAMP SWITCH INPUT	
• Ignition ON. • Monitor the REM stoplamp switch status PID while applying and releasing the brake pedal. • **Does the PID indicate active with the brake pedal applied and inactive with the brake pedal released?**	**Yes** GO to M8 . **No** GO to M2 .
M2 CHECK CIRCUIT 29-CF58 (OG/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Stoplamp Switch C278. • Measure the voltage between the stoplamp switch C278-1, circuit 29-CF58 (OG/GN), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to M3 . **No** VERIFY the CJB fuse 35 (5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.
M3 CHECK THE STOPLAMP SWITCH	
• Connect a fused (5A) jumper wire between the stoplamp switch C278-1, circuit 29-CF58 (OG/GN), harness side and the stoplamp switch C278-2, circuit 29S-CF1 (OG/BU), harness side.  • **Do the stoplamps illuminate?**	**Yes** INSTALL a new stoplamp switch. REFER to Stoplamp Switch in this section. TEST the system for normal operation. **No** If not equipped with stability assist, REMOVE the jumper wire. GO to M4 . If equipped with stability assist, REMOVE the jumper wire. GO to M5 .

M4 CHECK THE STOPLAMP SWITCH INPUT CIRCUIT TO THE REM	
• Connect: Stoplamp Switch C278. • Disconnect: REM C420b. • Measure the voltage between the REM C420b-13, circuit 29S-DK30 (OG), harness side and ground while applying the brake pedal.  • **Is the voltage greater than 10 volts?**	**Yes** GO to M8 . **No** REPAIR the input circuit between the REM and the stoplamp switch. TEST the system for normal operation.
M5 CHECK THE STOPLAMP SWITCH OUTPUT CIRCUIT TO THE ABS MODULE	
• Disconnect: ABS Module C155. • Measure the voltage between the ABS module C155-41, circuit 29S-CF1 (OG/BU), harness side and ground while applying the brake pedal.  • **Is the voltage greater than 10 volts?**	**Yes** GO to M6 . **No** REPAIR the input circuit between the ABS module and the stoplamp switch. TEST the system for normal operation.
M6 CHECK THE ABS MODULE	
• Connect a fused (5A) jumper wire between the ABS module C155-41, circuit 29S-CF1 (OG/BU), harness side and the ABS module C155-44, circuit 29S-CF2 (OG/BU), harness side.  • Apply the brake pedal and observe the stoplamps. • **Do the stoplamps illuminate?**	**Yes** GO to M9 . **No** LEAVE the jumper wire connected. GO to M7 .
M7 CHECK THE ABS MODULE OUTPUT CIRCUIT TO THE REM	

• Disconnect: REM C420b. • Measure the voltage between the REM C420b-13, circuit 29S-DK30 (OG), harness side and ground while applying the brake pedal.  • **Is the voltage greater than 10 volts?**	**Yes** GO to M8 . **No** REPAIR circuit 29S-CF2 (OG/BU) or circuit 29S-DK30 (OG). TEST the system for normal operation.
M8 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
M9 CHECK FOR CORRECT ABS MODULE OPERATION	
• Ignition OFF. • Disconnect the ABS module connector. • Check for: ♦ corrosion ♦ pushed-out pins • Connect the ABS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test N: One Or More Stoplamps Are Inoperative

Normal Operation

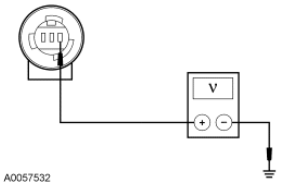
Each stoplamp is supplied battery voltage independently. Voltage from the battery junction box (BJB) flows through circuit 29S-LG6 (OG/YE) to circuit 29S-LG6A (OG/YE) and then on to the high mounted stoplamp. Voltage from the BJB flows through circuit 29S-LF23 (OG) to the LH stoplamp. Voltage from the BJB flows through circuit 29S-LF24 (OG/BK) to circuit 29S-LF23 (OG) and then on to the RH stoplamp. The stoplamp ground circuits are independently controlled by the rear electronic module (REM). When the REM receives voltage from the stoplamp switch (or ABS module if equipped with stability assist), the REM grounds circuits 31S-LG6 (BK/YE) (high mounted stoplamp), 31S-LG14 (BK/OG) (LH stoplamp) and 31S-LG21 (BK/GN) (RH stoplamp) to illuminate the stoplamps.

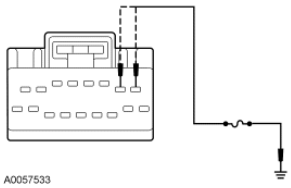
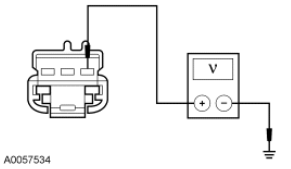
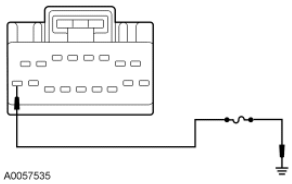
Possible Causes

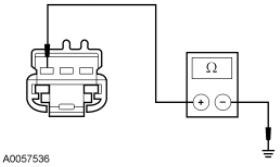
- Fuse

- Circuit 29S-LG6 (OG/YE) open
- Circuit 29S-LG6A (OG/YE) open
- Circuit 29S-LF23 (OG) open
- Circuit 29S-LF24 (OG/BK) open
- Circuit 31S-LG6 (BK/YE) open or short to voltage
- Circuit 31S-LG6A (BK/YE) open or short to voltage
- Circuit 31S-LG14 (BK/OG) open or short to voltage
- Circuit 31S-LG21 (BK/GN) open or short to voltage
- High mounted stoplamp
- REM

PINPOINT TEST N: ONE OR MORE STOPLAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
N1 DETERMINE THE INOPERATIVE STOPLAMP(S)	
• Ignition ON. • Apply the brake pedal and observe the stoplamps. • **Are all the stoplamps inoperative?**	**Yes** GO to Pinpoint Test M . **No** If the LH or RH stoplamp is inoperative, GO to N2 . If the high mounted stoplamp is inoperative, GO to N4 .
N2 CHECK THE VOLTAGE TO THE INOPERATIVE STOPLAMP	
• Ignition OFF. • Disconnect: LH Combination Lamp C414 or RH Combination Lamp C417. • Ignition ON. • Measure the voltage between the LH combination lamp C414-1, circuit 29S-LF23 (OG), harness side and ground; or between the RH combination lamp C417-1, circuit 29S-LF23 (OG), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** CONNECT the combination lamp. GO to N3 . **No** VERIFY the BJB fuse 3 (5A) or fuse 7 (5A) is OK. If OK, REPAIR circuit 29S-LF23 (OG) or circuit 29S-LF24 (OG/BK) as necessary. TEST the system for normal operation.
N3 CHECK THE REM	

• Disconnect: REM C420e. • **NOTE:** If the fuse in the jumper wire fails, repair the circuit for a short to voltage. • Connect a fused (5A) jumper wire between the REM C420e-2 (LH stoplamp), circuit 31S-LG14 (BK/OG), harness side and ground; or between the REM C420e-1 (RH stoplamp), circuit 31S-LG21 (BK/GN), harness side and ground.  A0057533 • **Does the inoperative stoplamp now illuminate?**	**Yes** GO to N7 . **No** REPAIR circuit 31S-LG14 (BK/OG) or circuit 31S-LG21 (BK/GN) as necessary. TEST the system for normal operation.
N4 CHECK FOR VOLTAGE TO THE HIGH MOUNTED STOPLAMP	
• Ignition OFF. • Disconnect: High Mounted Stoplamp C904. • Measure the voltage between the high mounted stoplamp C904-3, circuit 29S-LG6B (OG/YE), harness side and ground.  A0057534 • **Is the voltage greater than 10 volts?**	**Yes** CONNECT the high mounted stoplamp. GO to N5 . **No** VERIFY the BJB fuse 8 (5A) is OK. If OK, REPAIR circuits 29S-LG6A (OG/YE), 29S-LG6B (OG/YE) or 29S-LG6 (OG/YE) as necessary. TEST the system for normal operation.
N5 CHECK THE REM (HIGH MOUNTED STOPLAMP)	
• Disconnect: REM C420e. • **NOTE:** If the fuse in the jumper wire fails, repair the circuit for a short to voltage. • Connect a fused (5A) jumper wire between the REM C420e-17 (high mounted stoplamp), circuit 31S-LG6 (BK/YE), harness side and ground.  A0057535 • **Does the high mounted stoplamp now illuminate?**	**Yes** GO to N7 . **No** LEAVE the jumper wire connected. GO to N6 .

N6 CHECK CIRCUITS 31S-LG6 (BK/YE), 31S-LG6A (BK/YE) AND 31S-LG6B (BK/YE) FOR AN OPEN	
• Disconnect: High Mounted Stoplamp C904. • Measure the resistance between the high mounted stoplamp C904-1, circuit 31S-LG6B (BK/YE), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new high mounted stoplamp. REFER to High Mounted Stoplamp in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
N7 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Stoplamps Are On Continuously

Normal Operation — Vehicles Without Stability Assist

Each stoplamp is supplied battery voltage independently. The stoplamp ground circuits are independently controlled by the rear electronic module (REM). When the brake pedal is applied, the stoplamp switch allows voltage to flow through to circuit 29S-CF1 (OG/BU). Circuit 29S-CF1 (OG/BU) is spliced to carry the voltage to the powertrain control module (PCM) and the REM. Voltage to the REM (from the stoplamp switch) after the splice, is carried through circuit 29S-DK30 (OG). When the REM receives voltage from the stoplamp switch, the REM grounds circuits 31S-LG6 (BK/YE) (high mounted stoplamp), 31S-LG14 (BK/OG) (LH stoplamp) and 31S-LG21 (BK/GN) (RH stoplamp) to illuminate the stoplamps. The electric parking brake can also trigger the stoplamps by communicating to the REM (via the communication network) that the parking brake has been actuated while the vehicle is moving.

Normal Operation — Vehicles With Stability Assist

Each stoplamp is supplied battery voltage independently. The stoplamp ground circuits are independently controlled by the REM. When the brake pedal is applied, the stoplamp switch allows voltage to flow through circuit 29S-CF1 (OG/BU) to the anti-lock brake system (ABS) module. The ABS module then sends voltage through circuit 29S-CF2 (OG/BU), which is spliced to carry the voltage to the PCM and the REM. Voltage to the REM (from the ABS module) after the splice is carried through circuit 29S-DK30 (OG). When the REM receives voltage from the ABS module, the REM grounds circuits 31S-LG6 (BK/YE) (high mounted stoplamp), 31S-LG14 (BK/OG) (LH stoplamp) and 31S-LG21 (BK/GN) (RH stoplamp) to illuminate the stoplamps. The electric parking brake can also trigger the stoplamps by communicating to the REM (via the

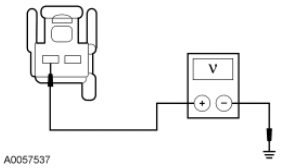
SCP link) that the parking brake has been actuated while the vehicle is moving.

Possible Causes

- Circuit 29S-CF1 (OG/BU) short to voltage
- Circuit 29S-CF2 (OG/BU) short to voltage
- Circuit 29S-CF58 (OG/GN) short to voltage
- Circuit 29S-DK30 (OG) short to voltage
- Circuit 29S-RE13 (OG) short to voltage
- Circuit 31S-LG6 (BK/YE) short to ground
- Circuit 31S-LG6A (BK/YE) short to ground
- Circuit 31S-LG6B (BK/YE) short to ground
- Circuit 31S-LG14 (BK/OG) short to ground
- Circuit 31S-LG21 (BK/GN) short to ground
- Stoplamp switch
- ABS module
- PCM
- REM
- Electric parking brake module

PINPOINT TEST O: THE STOPLAMPS ARE ON CONTINUOUSLY

Test Step	Result / Action to Take
O1 DETERMINE THE ALWAYS ON STOPLAMPS	
• Observe the stoplamps. • **Are all the stoplamps illuminated?**	**Yes** GO to O3 . **No** GO to O2 .
O2 CHECK THE CONTROL GROUND CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: REM C420e. • **Does the lamp continue to illuminate?**	**Yes** For the high mounted stoplamp, REPAIR circuit(s) 31S-LG6 (BK/YE), 31S-LG6A (BK/YE) or 31S-LG6B (BK/YE) as necessary. CLEAR the DTCs. REPEAT the self-test. For the LH stoplamp, REPAIR circuit 31S-LG14 (BK/OG). CLEAR the DTCs. REPEAT the self-test. For the RH stoplamp, REPAIR circuit 31S-LG21 (BK/GN) or circuit 31S-LG14 (BK/OG) as necessary. CLEAR the DTCs. REPEAT the self-test. **No** GO to O10 .
O3 CHECK THE STOPLAMP SWITCH	
• Ignition OFF. • Disconnect: Stoplamp Switch C278.	**Yes** If equipped with stability assist, GO to O4 . If not equipped with stability assist, GO to O6 .

• **Do the stoplamps continue to illuminate?**	**No** INSTALL a new stoplamp switch. REFER to Stoplamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
O4 CHECK THE ABS MODULE INPUT	
• Disconnect: ABS Module C155. • **Do the stoplamps continue to illuminate?**	**Yes** GO to O7 . **No** GO to O5 .
O5 CHECK CIRCUIT 29S-CF1 (OG/BU) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the stoplamp switch C278-2, circuit 29S-CF1 (OG/BU), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to O11 .
O6 CHECK THE ABS MODULE	
• Disconnect: ABS Module C135. • **Do the stoplamps continue to illuminate?**	**Yes** GO to O7 . **No** GO to O11 .
O7 CHECK THE ELECTRIC PARKING BRAKE MODULE	
• Disconnect: Electric Parking Brake Module C4206. • **Do the stoplamps continue to illuminate?**	**Yes** GO to O8 . **No** GO to O12 .
O8 CHECK THE PCM	
• Disconnect: PCM C175a. • **Do the stoplamps continue to illuminate?**	**Yes** GO to O9 . **No** GO to O13 .
O9 CHECK THE REM	
• Disconnect: REM C420b. • **Do the stoplamps continue to illuminate?**	**Yes** REPAIR circuit(s) 29S-DK30 (OG), 29S-CF1 (OG/BU), 29S-CF2 (OG/BU), 29S-CF58 (OG/GN) or 29S-RE13 (OG) as necessary. CLEAR the DTCs.

	REPEAT the self-test. **No** GO to O10 .
O10 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
O11 CHECK FOR CORRECT ABS MODULE OPERATION	
• Ignition OFF. • Disconnect the ABS module connector. • Check for: ♦ corrosion ♦ pushed-out pins • Connect the ABS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
O12 CHECK FOR CORRECT ELECTRIC PARKING BRAKE MODULE OPERATION	
• Ignition OFF. • Disconnect all the electric parking brake module connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the electric parking brake module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new electric parking brake module. REFER to Section 206-05 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
O13 CHECK FOR CORRECT PCM OPERATION	
• Ignition OFF. • Disconnect all the PCM connectors. • Check for:	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.

♦ corrosion ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Turn Signal and Hazard Lamps

Refer to Wiring Diagrams Cell 90 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Multifunction switch	• Battery junction box (BJB) fuse(s): ♦ 2 (10A) (RH rear turn signal lamp) ♦ 6 (10A) (LH rear turn signal lamp) • Central junction box (CJB) fuse(s): ♦ 8 (5A) (RH front parking/turn lamp) ♦ 10 (5A) (LH front parking/turn lamp) • Circuitry • Bulbs • Front electronic module (FEM) • Rear electronic module (REM) • Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP+, SCP-, ISO or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for FEM, refer to Section 419-10 .
    - No response/not equipped for REM, refer to Section 419-10 .
    - No response/not equipped for instrument cluster, refer to Section 413-01 .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the FEM, the REM or the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index, the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index or the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

8. If multiple symptoms exist, check the Switched System Power (SSP) Relay Index before proceeding to the next step. Refer to Headlamps in this section.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test P: The Turn Signal Lamps Are Inoperative

Normal Operation

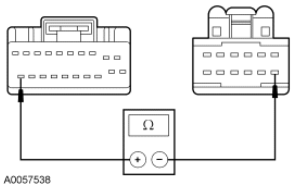
The instrument cluster sends out a voltage reference signal through circuit 8-LG43 (WH/VT) to the multifunction switch. The return signal is carried through circuit 9-LG43 (BN/WH) (shared with the high beam circuit) back to the instrument cluster. When the multifunction switch is placed in the RH or LH TURN positions, the voltage signal sent by the instrument cluster passes through a resistor within the multifunction

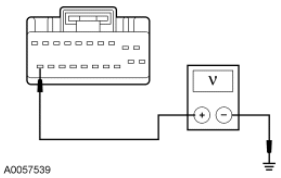
switch (specific to LH and RH turn positions) before returning to the instrument cluster.

Possible Causes

- Circuit 8-LG43 (WH/VT) open or short to voltage
- Multifunction switch
- Instrument cluster

PINPOINT TEST P: THE TURN SIGNAL LAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
P1 CHECK THE HIGH BEAM OPERATION	
• Ignition ON. • Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the HIGH BEAM position. • **Do the high beams operate correctly?**	**Yes** GO to P2 . **No** REFER to Headlamps in this section to continue diagnosis of the high beams.
P2 CHECK THE MULTIFUNCTION SWITCH OUTPUT	
• Place the headlamp switch in the OFF position. • Monitor the instrument cluster turn signal status PID while placing the multifunction switch in the RH and then LH TURN positions. • **Does the PID match the multifunction switch positions?**	**Yes** GO to P6 . **No** GO to P3 .
P3 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the multifunction switch OK?**	**Yes** GO to P4 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . CLEAR the DTCs. REPEAT the self-test.
P4 CHECK CIRCUIT 8-LG43 (WH/VT) FOR AN OPEN	
• Disconnect: Instrument Cluster C220b. • Measure the resistance between the instrument cluster C220b-20, circuit 8-LG43 (WH/VT), harness side and the multifunction switch C202-7, circuit 8-LG43 (WH/VT), harness side.  	**Yes** GO to P5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

• **Is the resistance less than 5 ohms?**	
P5 CHECK CIRCUIT 8-LG43 (WH/VT) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the instrument cluster C220b-20, circuit 8-LG43 (WH/VT), harness side and ground.  • **Is any voltage present?**	**Yes** GO to P6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
P6 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test Q: One Turn Signal Lamp Is Inoperative

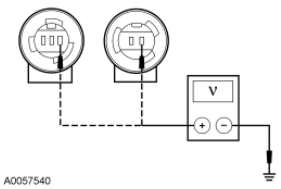
Normal Operation

Voltage is supplied from the central junction box (CJB) to the LH front turn signal lamp through circuits 29S-LF3 (OG/YE) and 29S-LF7 (OG/BU). The ground for the LH front turn signal lamp is passed through circuit 31S-LG18 (BK/YE) and then through circuit 31S-LG11 (BK/WH) to the front electronic module (FEM). Voltage is supplied from the CJB to the RH front turn signal lamp through circuits 29S-LF4 (OG/BU) and 29S-LF16 (OG/GN). The ground for the RH front turn signal lamp is passed through circuit 31S-LG18 (BK/YE) to the FEM. Voltage is supplied from the battery junction box (BJB) to the LH rear turn signal lamp through circuits 29S-LG1 (OG/YE) and 29S-LG12 (OG/YE). The ground for the LH rear turn signal lamp is passed through circuit 31S-LG12 (BK/YE) to the rear electronic module (REM). Voltage is supplied from the BJB to the RH rear turn signal lamp through circuits 29S-LG2 (OG/BU), 29S-LG19 (OG/BU) and 29S-LG12 (OG/YE). The ground for the RH rear turn signal lamp is passed through circuit 31S-LG12 (BK/YE) and then through circuit 31S-LG19 (BK/BU) to the REM. The FEM and REM individually control the ground circuits for the turn signal lamps. The timed on/off cycle is determined in the instrument cluster programming and is set to flash approximately 80 times per minute if both the front and rear turn signal lamps are good. If only one turn signal lamp is good, the instrument cluster will flash the remaining working turn signal lamp(s) approximately 160 times per minute.

Possible Causes

- Fuse
- Circuit 29S-LF3 (OG/YE) open
- Circuit 29S-LF7 (OG/BU) open
- Circuit 31S-LG18 (BK/YE) open or short to voltage
- Circuit 31S-LG11 (BK/WH) open or short to voltage
- Circuit 29S-LF4 (OG/BU) open
- Circuit 29S-LF16 (OG/GN) open
- Circuit 29S-LG1 (OG/YE) open
- Circuit 29S-LG12 (OG/YE) open
- Circuit 31S-LG12 (BK/YE) open or short to voltage
- Circuit 29S-LG2 (OG/BU) open
- Circuit 29S-LG19 (OG/BU) open
- Circuit 31S-LG19 (BK/BU) open or short to voltage
- FEM
- REM

PINPOINT TEST Q: ONE TURN SIGNAL LAMP IS INOPERATIVE

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>Q1 CHECK THE VOLTAGE SUPPLY TO THE TURN SIGNAL LAMP</td><td></td></tr>
<tr><td>
• Ignition OFF.
• Disconnect: Inoperative Turn Signal Lamp.
• Ignition ON.
• Measure the voltage between the inoperative lamp and ground as follows:
<table>
<tr><th>Inoperative Turn Signal Lamp Connector-Pin</th><th>Circuit</th></tr>
<tr><td>LH front parking/turn signal C1023-1</td><td>29S-LF16 (OG/GN)</td></tr>
<tr><td>RH front parking/turn signal C1043-1</td><td>29S-LF16 (OG/GN)</td></tr>
<tr><td>LH rear turn signal C413-1</td><td>29S-LG12 (OG/YE)</td></tr>
<tr><td>RH rear turn signal C416-1</td><td>29S-LG12 (OG/YE)</td></tr>
</table>


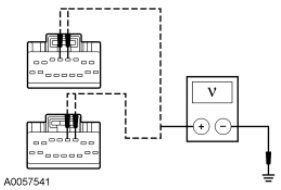
• Is the voltage greater than 10 volts?
</td><td>
Yes
GO to Q2 .

No
VERIFY the CJB fuse 8 (5A), fuse 10 (5A) or the BJB fuse 2 (10A) or fuse 6 (10A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
</td></tr>
</table>

Q2 CHECK THE CONTROL GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: FEM C201a or REM C420e.
- Measure the voltage between the FEM or the REM and ground as follows:

Inoperative Turn Signal Lamp	Connector-Pin	Circuit
LH front parking/turn signal	FEM C201a-5	31S-LG11 (BK/WH)
RH front parking/turn signal	FEM C201a-4	31S-LG18 (BK/YE)
LH rear turn signal	REM C420e-3	31S-LG12 (BK/YE)
RH rear turn signal	REM C420e-4	31S-LG19 (BK/BU)



- **Is any voltage present?**

Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to Q3 .

Q3 CHECK THE CONTROL GROUND CIRCUIT FOR AN OPEN

- Connect: Inoperative Turn Signal Lamp.
- Ignition ON.
- Connect a fused (5A) jumper wire between the FEM or the REM and ground as follows:

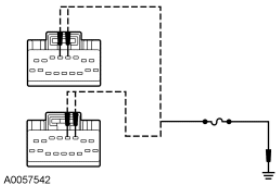
Inoperative Turn Signal Lamp	Connector-Pin	Circuit
LH front parking/turn signal	FEM C201a-5	31S-LG11 (BK/WH)
RH front	FEM C201a-4	31S-LG18

Yes
For the front turn signal lamp, GO to Q4 .

For the rear turn signal lamp, GO to Q5 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

parking/turn signal		(BK/YE)
LH rear turn signal	REM C420e-3	31S-LG12 (BK/YE)
RH rear turn signal	REM C420e-4	31S-LG19 (BK/BU)



- **Does the inoperative lamp now illuminate?**

Q4 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
Q5 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test R: One Turn Signal Lamp Is Always On

Normal Operation

Voltage is supplied from the central junction box (CJB) to the LH front turn signal lamp through circuits 29S-LF3 (OG/YE) and 29S-LF7 (OG/BU). The ground for the LH front turn signal lamp is passed through circuit 31S-LG18 (BK/YE) and then through circuit 31S-LG11 (BK/WH) to the front electronic module (FEM). Voltage is supplied from the CJB to the RH front turn signal lamp through circuits 29S-LF4 (OG/BU) and 29S-LF16 (OG/GN). The ground for the RH front turn signal lamp is passed through circuit 31S-LG18 (BK/YE) to the FEM. Voltage is supplied from the battery junction box (BJB) to the LH rear turn signal lamp through circuits 29S-LG1 (OG/YE) and 29S-LG12 (OG/YE). The ground for the LH rear turn signal lamp is passed through circuit 31S-LG12 (BK/YE) to the rear electronic module (REM). Voltage is supplied from the

BJB to the RH rear turn signal lamp through circuits 29S-LG2 (OG/BU), 29S-LG19 (OG/BU) and 29S-LG12 (OG/YE). The ground for the RH rear turn signal lamp is passed through circuit 31S-LG12 (BK/YE) and then through circuit 31S-LG19 (BK/BU) to the REM. The FEM and REM individually control the ground circuits for the turn signal lamps. The timed on/off cycle is determined in the instrument cluster programming and is set to flash approximately 80 times per minute if both the front and rear turn signal lamps are good. If only one turn signal lamp is good, the instrument cluster will flash the remaining working turn signal lamp(s) approximately 160 times per minute.

Possible Causes

- Circuit 31S-LG18 (BK/YE) short to ground
- Circuit 31S-LG11 (BK/WH) short to ground
- Circuit 31S-LG12 (BK/YE) short to ground
- Circuit 31S-LG19 (BK/BU) short to ground
- FEM
- REM

PINPOINT TEST R: ONE TURN SIGNAL LAMP IS ALWAYS ON

Test Step	Result / Action to Take
R1 CHECK THE CONTROL GROUND CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: FEM C201a or REM C420e. • Ignition ON. • Observe the turn signal lamp after disconnecting the FEM (front turn signal lamp always on) or REM (rear turn signal lamp always on). • **Does the lamp continue to illuminate?**	**Yes** REPAIR the control ground circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** For a front turn signal lamp, GO to R2 . For a rear turn signal lamp, GO to R3 .
R2 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
R3 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly.	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

• Operate the system and verify the concern is still present. • **Is the concern still present?**	REPEAT the self-test.

Pinpoint Test S: The Hazard Lamps Are Always On

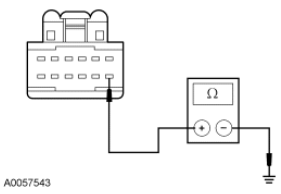
Normal Operation

The instrument cluster sends out a voltage reference signal through circuit 8-LG43 (WH/VT) to the multifunction switch. The return signal is carried through circuit 9-LG43 (BN/WH) (shared with the high beam circuit) back to the instrument cluster. When the hazard switch is engaged, the voltage signal sent by the instrument cluster passes directly through the multifunction switch and returns to the instrument cluster.

Possible Causes

- Circuit 8-LG43 (WH/VT) short to ground
- Multifunction switch
- Instrument cluster

PINPOINT TEST S: THE HAZARD LAMPS ARE ALWAYS ON

Test Step	Result / Action to Take
S1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the multifunction switch OK?**	**Yes** GO to S2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . CLEAR the DTCs. REPEAT the self-test.
S2 CHECK CIRCUIT 8-LG43 (WH/VT) FOR A SHORT TO GROUND	
• Disconnect: Instrument Cluster C220b. • Measure the resistance between the multifunction switch C202-7, circuit 8-LG43 (WH/VT), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to S3 .

S3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Parking, Rear and License Plate Lamps

Refer to Wiring Diagrams Cell 92 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch	• Battery junction box (BJB) fuse(s): ♦ 2 (10A) (license plate lamps) ♦ 3 (5A) (LH rear parking lamp) ♦ 7 (5A) (RH rear parking lamp) • Central junction box (CJB) fuse(s): ♦ 8 (5A) (RH front side marker and parking lamp) ♦ 10 (5A) (LH front side marker and parking lamp) • Circuitry • Bulbs • Front electronic module (FEM) • Rear electronic module (REM) • Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP+, SCP-, ISO or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for FEM, refer to Section 419-10 .
   - No response/not equipped for REM, refer to Section 419-10 .
   - No response/not equipped for instrument cluster, refer to Section 413-01 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the FEM, the REM or the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index, the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index or the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

8. If multiple symptoms exist, check the Switched System Power (SSP) Relay Index before proceeding to the next step. Refer to Headlamps in this section.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test T: The Exterior Lamps Are Inoperative

Normal Operation

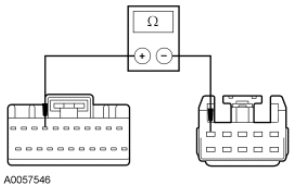
The instrument cluster monitors the headlamp switch position by sending out voltage reference signals to the headlamp switch. If a problem is detected with the circuits to the headlamp switch, the instrument cluster will default the headlamps and parking lamps on. When the headlamp switch is in the PARKING LAMPS ON position, the instrument cluster sends a signal to the front electronic module (FEM) and the rear electronic module (REM) to illuminate the parking lamps.

Possible Causes

- Circuit 8-LF14 (WH/BU) open
- Headlamp switch

- Instrument cluster

PINPOINT TEST T: THE EXTERIOR LAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
T1 CHECK THE HEADLAMP SWITCH OUTPUT	
• Ignition ON. • Monitor the instrument cluster headlamp switch status PID while placing the headlamp switch in the PARKING LAMPS ON position. • **Does the PID match with the headlamp switch position?**	**Yes** GO to T4 . **No** GO to T2 .
T2 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to T3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. TEST the system for normal operation.
T3 CHECK CIRCUIT 8-LF14 (WH/BU) FOR AN OPEN	
• Disconnect: Instrument Cluster C220c. • Measure the resistance between the instrument cluster C220c-8, circuit 8-LF14 (WH/BU), harness side and the headlamp switch C205-5, circuit 8-LF14 (WH/BU), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to T4 . **No** REPAIR the circuit. TEST the system for normal operation.
T4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test U: One Or More Parking, Rear Or License Plate Lamp Is Inoperative

Normal Operation

Voltage is supplied to the front lamps from the central junction box (CJB). Voltage is supplied to the rear lamps from the battery junction box (BJB). Voltage is supplied to the LH front side marker and parking lamp through circuits 29S-LF3 (OG/YE), 29S-LF7 (OG/BU), 29S-LF8 (OG) and 29S-LF16 (OG/GN). Ground for the LH front side marker flows through circuit 31S-LF8 (BK/OG) to the front electronic module (FEM). Ground for the LH front parking lamp flows through circuit 31S-LF16 (BK/RD) and then through circuit 31S-LF7 (BK/BU) to the FEM. Voltage is supplied to the RH front side marker and parking lamp through circuits 29S-LF4 (OG/BU), 29S-LF17 (OG/WH) and 29S-LF16 (OG/GN). Ground for the RH front side marker flows through circuit 31S-LF17 (BK/WH) to the FEM. Ground for the RH front parking lamp flows through circuit 31S-LF16 (BK/RD) to the FEM. Voltage is supplied to the LH rear parking lamp through circuit 29S-LF23 (OG). Ground for the LH rear parking lamp flows through circuit 31S-LF11 (BK/WH) to the rear electronic module (REM). Voltage is supplied to the RH rear parking lamp through circuits 29S-LF24 (OG/BK) and 29S-LF23 (OG). Ground for the RH rear parking lamp flows through circuit 31S-LF11 (BK/WH) and then circuit 31S-LF20 (BK/OG) to the REM. Voltage is supplied to the license plate lamps through circuits 29S-LG2 (OG/BU), 29S-LF12 (OG/BK), 29S-LF21 (OG/BK) and 29S-LF22 (OG/BK). Ground for the license plate lamps flows through circuits 31S-LF21 (BK/GN) and 31S-LF22 (BK/GN) and then through circuit 31S-LF12 (BK/GN) to the REM. The FEM and REM control the ground circuits individually for the lamps (the license plate lamps share a common ground controlled circuit at the REM).

Possible Causes

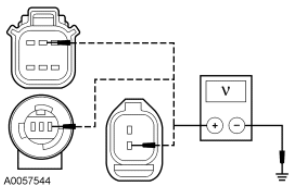
- Fuse
- Circuit 29S-LF8 (OG) open
- Circuit 29S-LF16 (OG/GN) open
- Circuit 31S-LF8 (BK/OG) open or short to voltage
- Circuit 31S-LF16 (BK/RD) open or short to voltage
- Circuit 31S-LF7 (BK/BU) open or short to voltage
- Circuit 29S-LF17 (OG/WH) open
- Circuit 31S-LF17 (BK/WH) open or short to voltage
- Circuit 29S-LF23 (OG) open
- Circuit 31S-LF11 (BK/WH) open or short to voltage
- Circuit 31S-LF20 (BK/OG) open or short to voltage
- Circuit 29S-LF21 (OG/BK) open
- Circuit 29S-LF22 (OG/BK) open
- Circuit 31S-LF12 (BK/GN) open or short to voltage
- Side marker module
- REM
- FEM

PINPOINT TEST U: ONE OR MORE PARKING, REAR OR LICENSE PLATE LAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
U1 CHECK FOR VOLTAGE TO THE INOPERATIVE LAMP(S)	

- Ignition OFF.
- Disconnect: Inoperative Lamp.
- Ignition ON.
- Measure the voltage between the inoperative lamp and ground as follows:

Inoperative Lamp	Connector-Pin	Circuit
LH front side marker	Headlamp assembly C1021-2	29S-LF8 (OG)
RH front side marker	Headlamp assembly C1041-2	29S-LF17 (OG/WH)
LH front parking/turn signal	C1023-1	29S-LF16 (OG/GN)
RH front parking/turn signal	C1043-1	29S-LF16 (OG/GN)
LH rear combination	C414-1	29S-LF23 (OG)
RH rear combination	C417-1	29S-LF23 (OG)
LH license plate	C452-1	29S-LF21 (OG/BK)
RH license plate	C462-1	29S-LF22 (OG/BK)



- **Is the voltage greater than 10 volts?**

Yes
GO to U2 .

No
VERIFY the CJB fuse 8 (5A), fuse 10 (5A), or the BJB fuse 3 (5A), fuse 7 (5A), or fuse 2 (10A) is OK. If OK, REPAIR the voltage supply circuit as necessary. TEST the system for normal operation.

U2 CHECK THE CONTROL GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: FEM C201b or C201c.
- Disconnect: REM C420a or C420e.
- Ignition ON.
- Measure the voltage between the FEM or the REM as follows:

Inoperative Lamp	Connector-Pin	Circuit
LH front side marker	FEM C201b-22	31S-LF8 (BK/OG)
RH front side marker	FEM C201b-11	31S-LF17 (BK/WH)

Yes
REPAIR the control ground circuit as necessary. TEST the system for normal operation.

No
GO to U3 .

LH front parking/turn signal	FEM C201c-2	31S-LF7 (BK/BU)
RH front parking/turn signal	FEM C201c-10	31S-LF16 (BK/RD)
LH rear combination	REM C420e-6	31S-LF11 (BK/WH)
RH rear combination	REM C420e-5	31S-LF20 (BK/OG)
NOTE: Both license plate lamps must be disconnected for correct test results. LH and RH license plate	REM C420a-5	31S-LF12 (BK/GN)

- **Is any voltage present?**

U3 CHECK THE CONTROL GROUND CIRCUIT FOR AN OPEN

- Connect: Inoperative Lamp(s).
- Connect a fused (5A) jumper wire between the FEM or the REM and ground as follows:

Inoperative Lamp	Connector-Pin	Circuit
LH front side marker	FEM C201b-22	31S-LF8 (BK/OG)
RH front side marker	FEM C201b-11	31S-LF17 (BK/WH)
LH front parking/turn signal lamp	FEM C201c-2	31S-LF7 (BK/BU)
RH front parking/turn signal lamp	FEM C201c-10	31S-LF16 (BK/RD)
LH rear combination lamp	REM C420e-6	31S-LF11 (BK/WH)
RH rear combination lamp	REM C420e-5	31S-LF20 (BK/OG)
LH and RH license plate lamp	REM C420a-5	31S-LF12 (BK/GN)

- **Does the inoperative lamp now illuminate?**

Yes
For the front parking or side marker lamp, GO to U5 .

For the rear parking lamp, GO to U6 .

No
For the front side marker, LEAVE the jumper wire connected. GO to U4 .

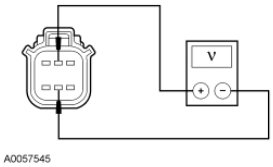
For all others, REPAIR the control ground circuit as necessary. TEST the system for normal operation.

U4 CHECK THE SIDE MARKER LAMP

- Disconnect: LH Headlamp C1021 or RH Headlamp C1041.
- Measure the voltage between the LH headlamp C1021-2, circuit 29S-LF8 (OG), harness side and the LH headlamp C1021-5, circuit 31S-LF8 (BK/OG), harness side; or between the RH headlamp C1041-2, circuit 29S-LF17 (OG/WH), harness side and the RH headlamp C1041-5, circuit 31S-LF17 (BK/WH), harness side

Yes
INSTALL a new front side marker module. REFER to Side Lamp/Front Turn Signal Lamp Bulb in this section. TEST the system for normal operation.

No

 • **Is the voltage greater than 10 volts?**	REPAIR circuit 31S-LF8 (BK/OG) (LH side marker) or circuit 31S-LF17 (BK/WH) (RH side marker) as necessary. TEST the system for normal operation.
U5 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
U6 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test V: The Parking, Rear Or License Plate Lamps Are On Continuously

Normal Operation

The instrument cluster monitors the headlamp switch position by sending out voltage reference signals to the headlamp switch. If a problem is detected with the circuits to the headlamp switch, the instrument cluster will default the headlamps and parking lamps on. When the headlamp switch is in the PARKING LAMPS ON position, the instrument cluster sends a signal to the front electronic module (FEM) and the rear electronic module (REM) to illuminate the parking lamps. Voltage is supplied to the LH front side marker and parking lamp through circuits 29S-LF3 (OG/YE), 29S-LF7 (OG/BU), 29S-LF8 (OG) and 29S-LF16 (OG/GN). Ground for the LH front side marker flows through circuit 31S-LF8 (BK/OG) to the FEM. Ground for the LH front parking lamp flows through circuit 31S-LF16 (BK/RD) and then through circuit 31S-LF7 (BK/BU) to the FEM. Voltage is supplied to the RH front side marker and parking lamp through circuits 29S-LF4 (OG/BU) 29S-LF17 (OG/WH) and 29S-LF16 (OG/GN). Ground for the RH front side marker flows through circuit 31S-LF17 (BK/WH) to the FEM. Ground for the RH front parking lamp flows through circuit 31S-LF16 (BK/RD) to the FEM. Voltage is supplied to the LH rear parking lamp through circuit 29S-LF23 (OG). Ground for the LH rear parking lamp flows through circuit 31S-LF11 (BK/WH) to the rear electronic

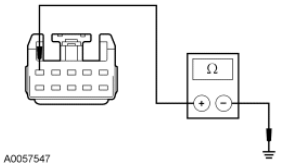
module (REM). Voltage is supplied to the RH rear parking lamp through circuits 29S-LF24 (OG/BK), and 29S-LF23 (OG). Ground for the RH rear parking lamp flows through circuit 31S-LF11 (BK/WH) and then circuit 31S-LF20 (BK/OG) to the REM. Voltage is supplied to the license plate lamps through circuits 29S-LG2 (OG/BU), 29S-LF12 (OG/BK), 29S-LF21 (OG/BK) and 29S-LF22 (OG/BK). Ground for the license plate lamps flows through circuits 31S-LF21 (BK/GN) and 31S-LF22 (BK/GN) and then through circuit 31S-LF12 (BK/GN) to the REM. The FEM and REM control the ground circuits individually for the lamps (the license plate lamps share a common ground controlled circuit at the REM).

Possible Causes

- Circuit 31S-LF8 (BK/OG) short to ground
- Circuit 31S-LF16 (BK/RD) short to ground
- Circuit 31S-LF7 (BK/BU) short to ground
- Circuit 31S-LF17 (BK/WH) short to ground
- Circuit 31S-LF11 (BK/WH) short to ground
- Circuit 31S-LF20 (BK/OG) short to ground
- Circuit 31S-LF21 (BK/GN) short to ground
- Circuit 31S-LF22 (BK/GN) short to ground
- Circuit 31S-LF12 (BK/GN) short to ground
- Circuit 8-LF14 (WH/BU) short to ground
- Headlamp switch
- Instrument cluster
- FEM
- REM

PINPOINT TEST V: THE PARKING, REAR OR LICENSE PLATE LAMPS ARE ON CONTINUOUSLY

Test Step	Result / Action to Take
V1 CHECK THE EXTERIOR LAMPS	
• Observe the exterior parking lamps. • **Are all the parking lamps illuminated?**	**Yes** GO to V2 . **No** GO to V6 .
V2 CHECK THE HEADLAMP SWITCH INPUT	
• Ignition ON. • Monitor the instrument cluster headlamp switch status PID while placing the headlamp switch in the PARKING LAMPS ON and then OFF positions. • **Does the PID match the headlamp switch position?**	**Yes** GO to V5 . **No** GO to V3 .
V3 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to V4 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. TEST the system for normal operation.

V4 CHECK CIRCUIT 8-LF14 (WH/BU) FOR A SHORT TO GROUND	
• Disconnect: Instrument Cluster C220c. • Measure the resistance between the headlamp switch C205-5, circuit 8-LF14 (WH/BU), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to V5 .
V5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
V6 CHECK THE CONTROL GROUND CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: REM C420a and C420e. • Disconnect: FEM C201b and C201c. • Ignition ON. • **Does the parking, rear or license plate lamps continue to illuminate?**	**Yes** REPAIR the control ground circuit as necessary. TEST the system for normal operation. **No** For the front lamp, GO to V7 . For the rear or license plate lamp, GO to V8 .
V7 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present.	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

• **Is the concern still present?**	
V8 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Fog Lamps

Refer to Wiring Diagrams Cell 86 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch	• Underhood auxiliary junction box (AJB) fuse 3 (15A) (fog lamp relay) • Fog lamp relay • Circuitry • Front electronic module (FEM) • Instrument cluster

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP+, SCP-, ISO or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for FEM, refer to Section 419-10 .
   - No response/not equipped for instrument cluster, refer to Section 413-01 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the FEM or the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index or the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

8. If multiple symptoms exist, check the Switched System Power (SSP) Relay Index before proceeding to the next step. Refer to Headlamps in this section.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test W: The Fog Lamps Are Inoperative

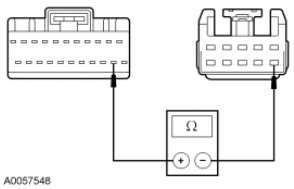
Normal Operation

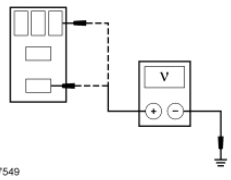
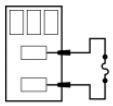
The instrument cluster sends a voltage signal to the headlamp switch through circuit 8-LD10 (WH/BK). When the fog lamp switch is engaged, the signal is allowed to return to the instrument cluster. When the instrument cluster detects that the fog lamp switch is engaged, a message is sent to the front electronic module (FEM) via the communication network to command the fog lamps on. The fog lamp relay receives voltage from circuits 30-LD8A (RD/OG) and 30-LD8B (RD). The fog lamp relay coil is grounded through circuit 31S-LD9 (BK/GN) to the FEM. When the FEM grounds circuit 31S-LD9 (BK/GN), the fog lamp relay is energized, switching voltage to circuit 30S-LD2 (RD/BU). Voltage then flows through circuits 30S-LD11 (RD/WH) and 30S-LD17 (RD/WH) to the LH and RH fog lamps, respectively. Ground for the LH fog lamp is through circuit 31-LD11 (BK/WH). Ground for the RH fog lamp is through circuit 31-LD17 (BK/WH).

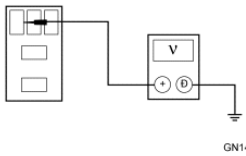
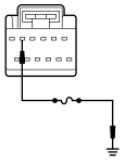
Possible Causes

- Fuse
- Circuit 8-LD10 (WH/BK) open
- Circuit 31S-LD9 (BK/GN) open or short to voltage
- Circuit 30-LD8A (RD/OG) open
- Circuit 30-LD8B (RD) open
- Circuit 30S-LD2 (RD/BU) open
- Fog lamp relay
- Headlamp switch
- Instrument cluster
- FEM

PINPOINT TEST W: THE FOG LAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
W1 CHECK THE HEADLAMP SWITCH OUTPUT	
• Ignition ON. • Monitor the instrument cluster fog lamp switch status PID while placing the headlamp switch in the PARKING LAMPS ON position and then engaging the fog lamp switch. • **Does the PID match the headlamp switch position?**	**Yes** GO to W5 . **No** GO to W2 .
W2 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to W3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. TEST the system for normal operation.
W3 CHECK CIRCUIT 8-LD10 (WH/BK) FOR AN OPEN	
• Disconnect: Instrument Cluster C220c. • Measure the resistance between the instrument cluster C220c-13, circuit 8-LD10 (WH/BK), harness side and the headlamp switch C205-6, circuit 8-LD10 (WH/BK), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to W4 . **No** REPAIR the circuit. TEST the system for normal operation.
W4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
W5 CHECK THE FOG LAMP RELAY	

• Ignition OFF. • Disconnect: Fog Lamp Relay C1007. • Carry out the fog lamp relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the fog lamp relay OK?**	**Yes** GO to W6 . **No** INSTALL a new fog lamp relay. TEST the system for normal operation.
W6 CHECK CIRCUITS 30-LD8A (RD/OG) AND 30-LD8B (RD) FOR AN OPEN	
• Measure the voltage between the fog lamp relay C1007-3, circuit 30-LD8A (RD/OG), harness side and ground; and between the fog lamp relay C1007-1, circuit 30-LD8B (RD), harness side and ground.  A0057549 • **Are the voltages greater than 10 volts?**	**Yes** GO to W7 . **No** VERIFY the underhood auxiliary junction box (AJB) fuse 3 (15A) is OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.
W7 CHECK CIRCUIT 30S-LD2 (RD/BU) FOR AN OPEN	
• Connect a fused (15A) jumper wire between the fog lamp relay C1007-3, circuit 30-LD8A (RD/OG), harness side and the fog lamp relay C1007-5, circuit 30-LD2 (RD/BU), harness side.  A0057550 • **Do the fog lamps illuminate?**	**Yes** REMOVE the jumper wire. GO to W8 . **No** REPAIR the circuit. TEST the system for normal operation.
W8 CHECK CIRCUIT 31S-LD9 (BK/GN) FOR A SHORT TO VOLTAGE	
• Disconnect: FEM C201c. • Ignition ON. • Measure the voltage between the fog lamp relay C1007-2, circuit 31S-LD9 (BK/GN), harness side and ground.	**Yes** GO to W9 . **No** REPAIR the circuit. TEST the system for normal operation.

 GN1460-A • **Is any voltage present?**	
W9 CHECK CIRCUIT 31S-LD9 (BK/GN) FOR AN OPEN	
• Ignition OFF. • Connect: Fog Lamp Relay C1007. • Connect a fused (10A) jumper wire between the FEM C201c-5, circuit 31S-LD9 (BK/GN), harness side and ground.  A0057551 • **Do the fog lamps illuminate?**	**Yes** GO to W10 . **No** REPAIR the circuit. TEST the system for normal operation.
W10 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test X: The Fog Lamps Are On Continuously

Normal Operation

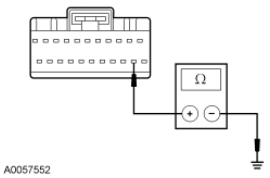
The instrument cluster sends a voltage signal to the headlamp switch through circuit 8-LD10 (WH/BK). When the fog lamp switch is engaged, the signal is allowed to return to the instrument cluster. When the instrument cluster detects that the fog lamp switch is engaged, a signal is sent to the front electronic module (FEM) via the communication network to command the fog lamps on. The fog lamp relay receives voltage from circuits 30-LD8A (RD) and 30-LD8B (RD). The fog lamp relay coil is ground through circuit 31S-LD9 (BK/GN) to the FEM. When the FEM grounds circuit 31S-LD9 (BK/GN), the fog lamp relay is energized, switching voltage to circuit 30S-LD2 (RD/BU). Voltage then flows through circuits 30S-LD11 (RD/WH) and 30S-LD17 (RD/WH) to the LH and RH fog lamps, respectively.

Possible Causes

- Circuit 8-LD10 (WH/BK) short to ground
- Circuit 31S-LD9 (BK/GN) short to ground
- Circuit 30S-LD11 (RD/WH) short to voltage
- Circuit 30S-LD17 (RD/WH) short to voltage

- Circuit 30S-LD2 (RD/BU) short to voltage
- Fog lamp relay
- Headlamp switch
- Instrument cluster
- FEM

PINPOINT TEST X: THE FOG LAMPS ARE ON CONTINUOUSLY

Test Step	Result / Action to Take
X1 CHECK THE HEADLAMP SWITCH OUTPUT	
• Ignition ON. • Monitor the instrument cluster fog lamp switch status PID while placing the headlamp switch in the PARKING LAMPS ON position and then engaging the fog lamp switch. • **Does the PID match the headlamp switch position?**	**Yes** GO to X5 . **No** GO to X2 .
X2 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to X3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
X3 CHECK CIRCUIT 8-LD10 (WH/BK) FOR A SHORT TO GROUND	
• Disconnect: Instrument Cluster C220c. • Measure the resistance between the instrument cluster C220c-13, circuit 8-LD10 (WH/BK), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to X4 .
X4 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Ignition OFF. • Disconnect all the instrument cluster connectors. • Check for: ♦ corrosion ♦ pushed-out pins	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. **No**

• Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
X5 CHECK THE FEM	
• Ignition OFF. • Disconnect: FEM C201c. • Ignition ON. • **Do the fog lamps continue to illuminate?**	**Yes** GO to X7 . **No** GO to X6 .
X6 CHECK FOR CORRECT FEM OPERATION	
• Ignition OFF. • Disconnect all the FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
X7 CHECK CIRCUITS 30S-LD2 (RD/BU), 30S-LD11 (RD/WH) AND 30S-LD17 (RD/WH) FOR A SHORT TO VOLTAGE	
• Disconnect: Fog Lamp Relay C1007. • **Do the fog lamps continue to illuminate?**	**Yes** REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the self-test. **No** GO to X8 .
X8 CHECK THE FOG LAMP RELAY	
• Carry out the fog lamp relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the fog lamp relay OK?**	**Yes** REPAIR circuit 31S-LD9 (BK/GN). CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new fog lamp relay. CLEAR the DTCs. REPEAT the self-test.

Reversing Lamps

Refer to Wiring Diagrams Cell 93 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the following for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Digital transmission range (TR) sensor	• Battery junction box (BJB) fuse 6 (10A) (reversing lamps) • Circuitry • Bulbs • Rear electronic module (REM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
   - SCP+, SCP-, ISO or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
   - No response/not equipped for REM, refer to Section 419-10 .
   - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the REM.

7. If the DTCs retrieved are related to the concern, go to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index.

8. If multiple symptoms exist, check the Switched System Power (SSP) Relay Index before proceeding to the next step. Refer to Headlamps in this section.

9. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test Y: The Reversing Lamps Are Inoperative

Normal Operation

The powertrain control module (PCM) monitors the digital transmission range (TR) sensor. When the PCM detects the transmission is in REVERSE, a signal is sent to the rear electronic module (REM) to illuminate the reversing lamps. Voltage from the battery junction box (BJB) is sent through circuit 29S-LG1 (OG/YE) to circuits 29S-LG9 (OG/BK) and 29S-LG16 (OG/GN) to the LH and RH reversing lamps respectively. Ground for the LH reversing lamp is sent through circuit 31S-LG9 (BK/GN) to the REM. Ground for the RH reversing lamp is sent through circuit 31S-LG16 (BK/RD) to the REM. The REM individually controls the ground circuits for the reversing lamps.

Possible Causes
- REM
- PCM

PINPOINT TEST Y: THE REVERSING LAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
Y1 CHECK THE VOLTAGE SUPPLY TO THE REVERSING LAMPS	
• Ignition ON.	**Yes** GO to Y2 .

• Place the multifunction switch in the LH TURN position and observe the LH rear turn signal. • **Does the LH rear turn signal operate correctly?**	**No** REFER to Turn Signal and Hazard Lamps in this section to continue diagnosis of the turn lamp.
Y2 CHECK THE PCM	
• Ignition ON. • Apply the parking brake. • Monitor the PCM transmission gear status PID while placing the transmission in REVERSE and then NEUTRAL. • **Does the PID match the transmission gear selected?**	**Yes** GO to Y4 . **No** GO to Y3 .
Y3 CHECK FOR CORRECT PCM OPERATION	
• Ignition OFF. • Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
Y4 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Z: The Individual Reversing Lamp Is Inoperative

Normal Operation

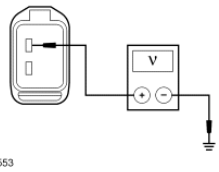
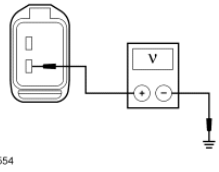
When the powertrain control module (PCM) detects the transmission is in REVERSE, a signal is sent to the rear electronic module (REM) to illuminate the reversing lamps. Voltage from the battery junction box (BJB) is sent through circuit 29S-LG1 (OG/YE) to circuits 29S-LG9 (OG/BK) and 29S-LG16 (OG/GN) to the LH and RH reversing lamps, respectively. Ground for the LH reversing lamp is sent through circuit 31S-LG9 (BK/GN) to the REM. Ground for the RH reversing lamp is sent through circuit 31S-LG16 (BK/RD) to the REM. The REM individually controls the ground circuits for the reversing lamps.

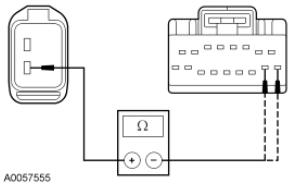
Possible Causes

- Circuit 29S-LG9 (OG/BK) open

- Circuit 29S-LG16 (OG/GN) open
- Circuit 31S-LG9 (BK/GN) open or short to voltage
- Circuit 31S-LG16 (BK/RD) open or short to voltage
- REM

PINPOINT TEST Z: THE INDIVIDUAL REVERSING LAMP IS INOPERATIVE

Test Step	Result / Action to Take
Z1 CHECK CIRCUIT 29S-LG9 (OG/BK) OR CIRCUIT 29S-LG16 (OG/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Inoperative Reversing Lamp. • Ignition ON. • Measure the voltage between the LH reversing lamp C451-2, circuit 29S-LG9 (OG/BK), harness side and ground; or between the RH reversing lamp C461-2, circuit 29S-LG16 (OG/GN), harness side and ground.  A0057553 • **Is the voltage greater than 10 volts?**	**Yes** GO to Z2 . **No** REPAIR the circuit in question. TEST the system for normal operation.
Z2 CHECK CIRCUIT 31S-LG9 (BK/GN) OR CIRCUIT 31S-LG16 (BK/RD) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: REM C420e. • Ignition ON. • Measure the voltage between the LH reversing lamp C451-1, circuit 31S-LG9 (BK/GN), harness side and ground; or between the RH reversing lamp C461-1, circuit 31S-LG16 (BK/RD), harness side and ground.  A0057554 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to Z3 .
Z3 CHECK CIRCUIT 31S-LG9 (BK/GN) OR CIRCUIT 31S-LG16 (BK/RD) FOR AN OPEN	

• Ignition OFF. • Measure the resistance between the LH reversing lamp C451-1, circuit 31S-LG9 (BK/GN), harness side and the REM C420e-9, circuit 31S-LG9 (BK/GN), harness side; or between the RH reversing lamp C461-1, circuit 31S-LG16 (BK/RD), harness side and the REM C420e-10, circuit 31S-LG16 (BK/RD), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to Z4 . **No** REPAIR the circuit in question. TEST the system for normal operation.
Z4 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AA: The Reversing Lamp(s) Are On Continuously

Normal Operation

The powertrain control module (PCM) monitors the digital transmission range (TR) sensor. When the PCM detects the transmission is in REVERSE, a signal is sent to the rear electronic module (REM) to illuminate the reversing lamps. Ground for the LH reversing lamp is sent through circuit 31S-LG9 (BK/GN) to the REM. Ground for the RH reversing lamp is sent through circuit 31S-LG16 (BK/RD) to the REM. The REM individually controls the ground circuits for the reversing lamps.

Possible Causes

- Circuit 31S-LG9 (BK/GN) short to ground
- Circuit 31S-LG16 (BK/RD) short to ground
- REM
- PCM

PINPOINT TEST AA: THE REVERSING LAMP(S) ARE ON CONTINUOUSLY

Test Step	Result / Action to Take

AA1 CHECK THE REVERSING LAMPS	
• Ignition ON. • Observe the reversing lamps. • **Are both reversing lamps illuminated?**	**Yes** GO to AA2 . **No** GO to AA4 .
AA2 CHECK THE PCM	
• Ignition OFF. • Disconnect: PCM C175a. • Ignition ON. • **Do the reversing lamps continue to illuminate?**	**Yes** GO to AA5 . **No** GO to AA3 .
AA3 CHECK FOR CORRECT PCM OPERATION	
• Ignition OFF. • Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
AA4 CHECK THE REM	
• Ignition OFF. • Disconnect: REM C420e. • Ignition ON. • **Does the reversing lamp continue to illuminate?**	**Yes** REPAIR circuit 31S-LG9 (BK/GN) (LH reversing lamp) or circuit 31S-LG16 (BK/RD) (RH reversing lamp) as necessary. TEST the system for normal operation. **No** GO to AA5 .
AA5 CHECK FOR CORRECT REM OPERATION	
• Ignition OFF. • Disconnect all the REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all the REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Daytime Running Lamps (DRL)

Refer to Wiring Diagrams Cell 87 for schematic and connector information.

Inspection and Verification

NOTE: When installing a new front electronic module (FEM), it must be reconfigured for this feature. Refer to Section 418-01 .

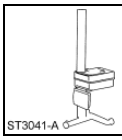
1. Verify the customer concern by operating the daytime running lamps (DRL) following these steps:
   - Place the ignition switch in the RUN position.
   - Place the headlamp switch in the OFF position.
   - If the DRL does not operate, make sure the FEM is configured for DRL before proceeding to the next step.

2. Verify the high beam operation.
   - Place the headlamp switch in the headlamps ON position.
   - Place the multifunction switch in the HIGH BEAM position.

   If the high beams operate correctly and the DRL operation is incorrect, install a new FEM. Refer to Section 419-10 . Test the system for normal operation.
   If the high beam operation is incorrect, refer to Headlamps in this section.

Headlamp Adjustment

Special Tool(s)

 ST3041-A	Vision 100 Headlamp Aimer 196-00005 or equivalent

Headlamp Aiming

1. The headlamp aiming procedure depends on what type of beam pattern the headlamp is equipped with. Vehicles may come equipped with VOL, VOR or SAE only (includes sealed beam type) headlamps. To identify the headlamp beam pattern, look on the headlamp lens. Molded in small letters on the headlamp lens is one of the following:
    - SAE
    - VOL and SAE
    - VOR and SAE

2. Once the headlamp beam pattern is identified, aim the headlamps using one of the following methods as applicable.
    - Photometric aimers can aim VOL-, VOR- and SAE-type headlamps only. This is the preferred method of headlamp aiming.
    - Visual or screen method aiming can be used to aim VOL-, VOR- and SAE-type headlamps only.
    - Mechanical aimers cannot be used with VOR- or VOL-type headlamps. Aerodynamic lamps that can be aimed mechanically have 3 nibs molded into the lens of the lamp.

Photometric Aiming

1. For the photometric aiming procedure, refer to the appropriate photometric headlamp aimer instruction manual.

Screen Method Aiming

All headlamp types

NOTE: Horizontal aim is not adjustable for VOL or VOR headlamps.

NOTE: Consult your state vehicle inspection manual for recommended tolerance ranges for visual aiming.

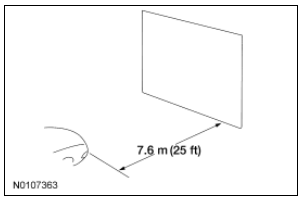
NOTE: The sight shield may need to be positioned or removed for access to the adjusters.

1. Before starting headlamp adjustment:
    - check the tire inflation.
    - check that no other load is in the vehicle other than a half tank of fuel.
    - check that the headlamps are clean.

- check for correct headlamp operation.
- check that the vehicle is on level ground.
- if the vehicle is equipped with air suspension, make sure that the switch is on.

2. **NOTE:** The vertical wall or screen must be a minimum of 2.4 m (8 ft) wide.

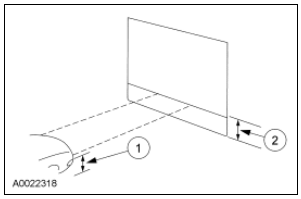
   Park the vehicle on a level surface approximately 7.6 m (25 ft) from the vertical wall or screen directly in front of it.



3. **NOTE:** The center of the lamp is marked either on the lens (circle, crosshair or other mark) or on the bulb shield internal to the lamp (crosshair or other mark).

   Mark a horizontal reference line on the vertical wall or screen.

   1. Measure the center of the headlamp height to ground and record the measurement.
   2. Make a 2.4 m (8 ft) horizontal mark (using masking tape) on the vertical wall or screen at the same distance from the ground as previously recorded.



4. **NOTE:** This procedure should be done in a dark environment to effectively see the headlamp beam pattern.

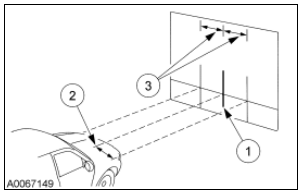
   Turn on the low beam headlamps to illuminate the wall or screen and open the hood.

5. **NOTE:** For SAE-type headlamps, the appearance of the beam pattern may vary between vehicles.

   On the wall or screen, locate the high intensity area of the beam pattern. Place the top edge of the high intensity zone even with the horizontal reference line.

SAE-type headlamps

6. In addition to the horizontal line marked in Step 3, a pair of vertical lines must be marked at the center line of the headlamps on the wall or screen.
   1. Mark the center line of the vehicle on the wall or screen.
   2. Measure from the center of the headlamp to the center line of the vehicle.
   3. Make two 1.5 m (5 ft) vertical marks (using masking tape) on the wall or screen at the same distance from the vehicle center line as previously recorded.

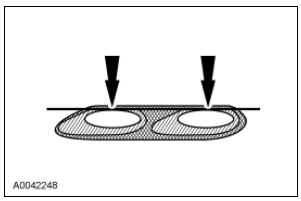


7. On the wall or screen, locate the high intensity area of the beam pattern. Place the left edge of the high intensity zone even with the vertical line corresponding to the headlamp being adjusted.

VOR-type headlamps

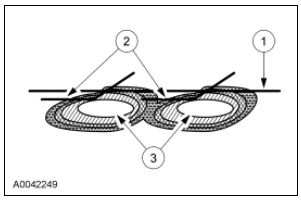
8. **NOTE:** The appearance of the VOR beam pattern may vary between vehicles.

   Identify at the top edge of this high intensity area a distinct horizontal cutoff in the beam pattern. If the top edge of this cutoff is not even with the horizontal reference line, the headlamp beam needs to be adjusted.



VOL-type headlamps

9. For VOL-type headlamps, there is a distinct cutoff in the left portion of the beam pattern. The edge of this cutoff should be positioned 50.2 mm (2 in) below the horizontal reference line.
   1. Horizontal reference line.
   2. Top edge of the beam pattern.
   3. High intensity zone.



Mechanical Aiming

1. For the mechanical aiming procedure, refer to the appropriate mechanical headlamp aimer instruction manual.

Front Fog Lamp Adjustment

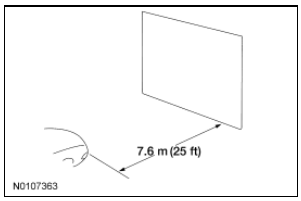
1. **NOTE:** Horizontal aim is not required for this vehicle and is not adjustable. Consult your state vehicle inspection center for recommended tolerance ranges for visual aiming.

   Before starting the fog lamp assembly adjustment:

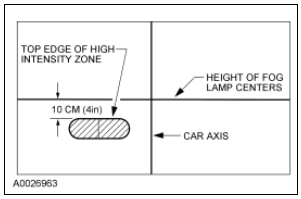
   - check the tire inflation.
   - make sure there are no other loads in the vehicle other than a half tank of fuel.
   - make sure the vehicle is on level ground.
   - make sure the fog lamps and headlamps are clean.
   - make sure the headlamps are operating and are correctly aimed.

2. **NOTE:** The vertical wall screen must be a minimum of 2.4 m (8 ft) wide.

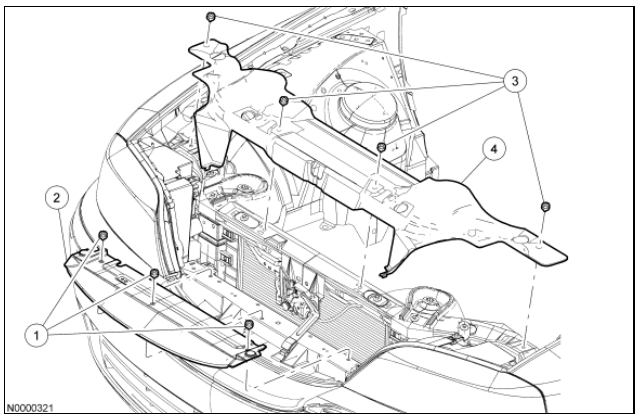
   Park the vehicle on a level surface approximately 7.6 m (25 ft) from the vertical wall or screen directly in front of it.



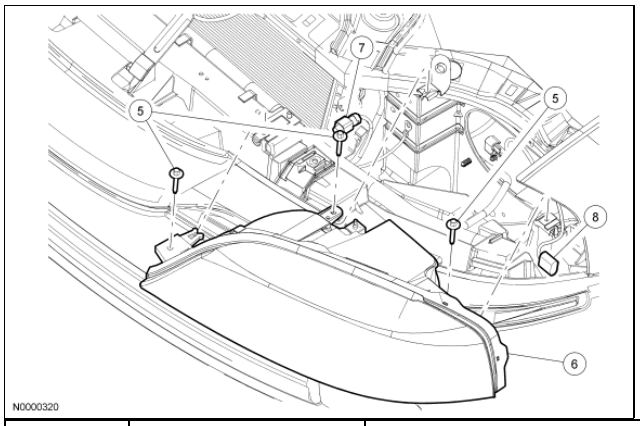
3. The correct visual aim for the fog lamps is with the top edge of the high-intensity zone 10 cm (4 in) below the horizontal center of the fog lamps.



Headlamp Assembly



Item	Part Number	Description
1	—	Pin-type retainers (3 required)
2	8C300	Radiator grille opening cover
3	—	Pin-type retainers (4 required)
4	8C291	Radiator sight shield



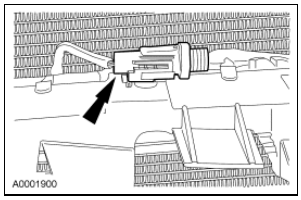
Item	Part Number	Description
5	N606679	Headlamp assembly bolts (3 required)
6	13008	Headlamp assembly
7	14290	Headlamp assembly electrical connector
8	13411	Parking/turn lamp electrical connector

Removal and Installation

NOTE: Make sure the headlamp switch and ignition switch are in the OFF position.

1. Remove the 3 radiator grille opening cover pin-type retainers.

2. Position the ambient air temperature sensor aside.



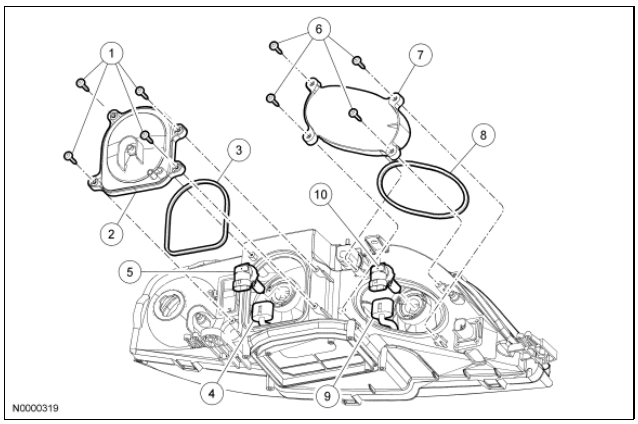
3. Remove the radiator grille opening cover.

4. Remove the 4 pin-type retainers and the radiator sight shield.

5. Remove the 3 bolts and the headlamp assembly.
   - Disconnect the electrical connectors.

6. To install, reverse the removal procedure.

Headlamp Bulb



Item	Part Number	Description
1	13378	Low beam access cover screws (4 required)
2	13071	Low beam access cover
3	13022	Low beam access cover seal
4	—	Low beam electrical connector (part of 13008)
5	13N021	Low beam bulb
6	13378	High beam access cover screws (4 required)
7	13071	High beam access cover
8	13022	High beam access cover seal
9	—	High beam electrical connector (part of 13008)
10	13N021	High beam bulb

Removal and Installation

⚠ WARNING: The headlamp bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

NOTE: The headlamp bulb should not be removed from the headlamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp with the bulb removed from the headlamp.

High and low beam bulbs

1. Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.

Low beam bulb

2. Remove the 4 screws and the low beam access cover.

3. Remove the low beam bulb.
   - Disconnect the electrical connector.

High beam bulb

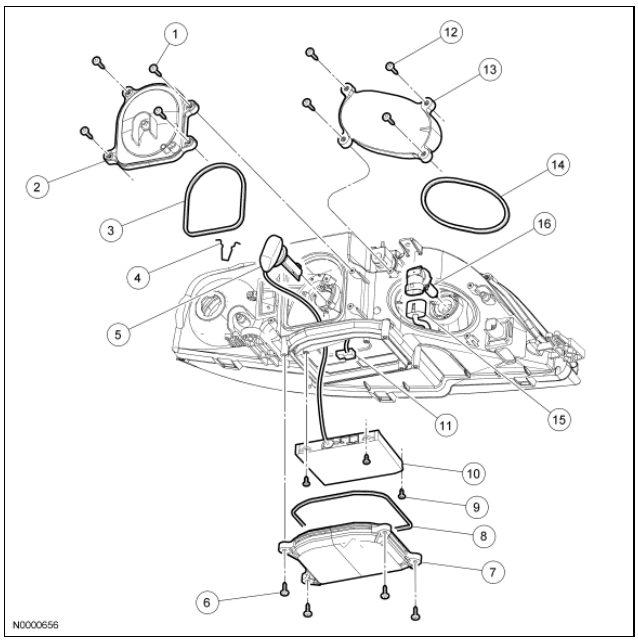
4. Remove the 4 screws and the high beam access cover.

5. Remove the high beam bulb.
    - Disconnect the electrical connector.

High and low beam bulbs

6. To install, reverse the removal procedure.

Headlamp Bulb — High Intensity Discharge (HID)



Item	Part Number	Description
1	13378	Low beam access cover screws (4 required)
2	13071	Low beam access cover
3	13022	Low beam access cover seal
4	—	High intensity discharge (HID) lamp retainer (part of 13008)
5	13D109	HID low beam bulb
6	13378	Ballast access cover screws (4 required)
7	13180	Ballast access cover
8	13160	Ballast access cover seal
9	—	Ballast screws (3 required)
10	13C170	Ballast and bulb assembly
11	—	Ballast electrical connector (part of 13008)
12	13378	High beam access cover screws (4 required)
13	13071	High beam access cover
14	13160	High beam access cover seal
15	—	High beam electrical connector (part of 13008)
16	13N021	High beam bulb

Removal and Installation

⚠ WARNING: The headlamp bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

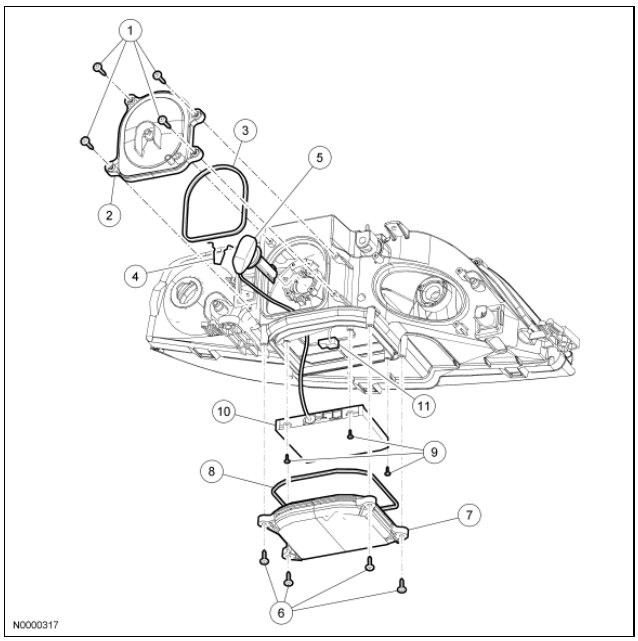
NOTE: The headlamp bulb should not be removed from the headlamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp with the bulb removed from the headlamp.

1. Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.
2. Remove the 4 screws and the low beam access cover.
3. Release the spring retainer and separate the HID bulb from the headlamp assembly.
4. Remove the 4 screws and the ballast access cover.
5. **NOTE:** Feed the HID bulb and harness through the headlamp assembly.

   Remove the 3 screws and the ballast.

   - Disconnect the electrical connector.
6. To install, reverse the removal procedure.

Ballast



Item	Part Number	Description
1	13378	Low beam access cover screws (4 required)
2	13071	Low beam access cover
3	13022	Low beam access cover seal
4	—	High intensity discharge (HID) lamp retainer (part of 13008)
5	13D109	HID low beam bulb
6	13378	Ballast access cover screws (4 required)
7	13180	Ballast access cover
8	13160	Ballast access cover seal
9	—	Ballast screws (3 required)
10	13C170	Ballast and bulb assembly
11	—	Ballast electrical connector (part of 13008)

Removal and Installation

⚠ WARNING: The headlamp bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

NOTE: The headlamp bulb should not be removed from the headlamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp with the bulb removed from the headlamp.

1. Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.

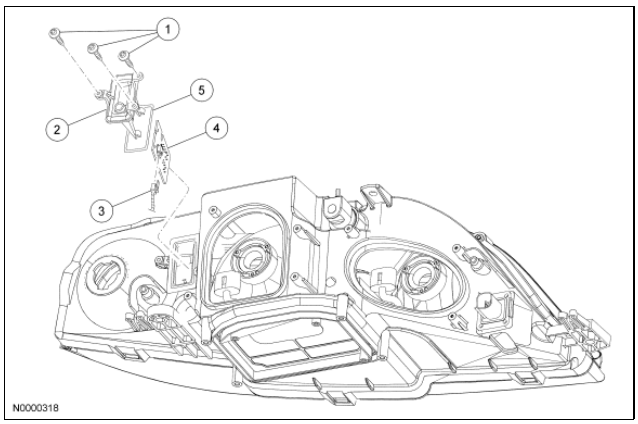
2. Remove the 4 screws and the low beam access cover.
3. Release the spring retainer and separate the HID bulb from the headlamp assembly.
4. Remove the 4 screws and the ballast access cover.
5. **NOTE:** Feed the HID bulb and harness through the headlamp assembly

   Remove the 3 screws and the ballast.

   - Disconnect the electrical connector.

6. To install, reverse the removal procedure.

Side Lamp/Front Turn Signal Lamp Bulb



Item	Part Number	Description
1	—	Side marker module screws (3 required) (part of 13008)
2	—	Side marker module bracket (part of 13008)
3	—	Side marker module electrical connector (part of 13008)
4	—	Side marker module (part of 13008)
5	—	Side marker module seal (part of 13008)

Removal and Installation

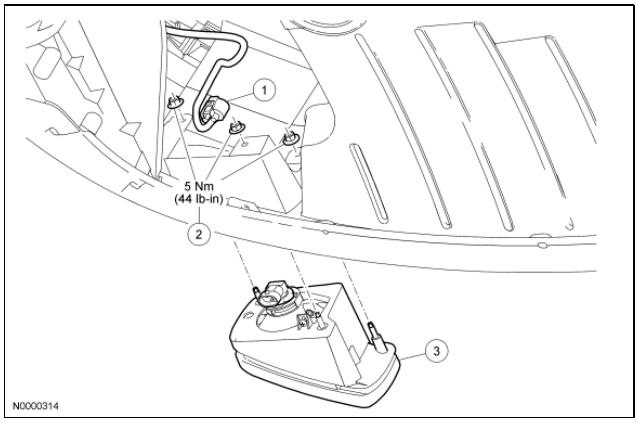
1. Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.

2. Remove the 3 screws and the side marker module.
   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

Fog Lamp

NOTE: Make sure the headlamp switch and ignition switch are in the OFF position.



Item	Part Number	Description
1	14290	Fog lamp electrical connector
2	N621906	Fog lamp nuts (3 required)
3	15A255	Fog lamp

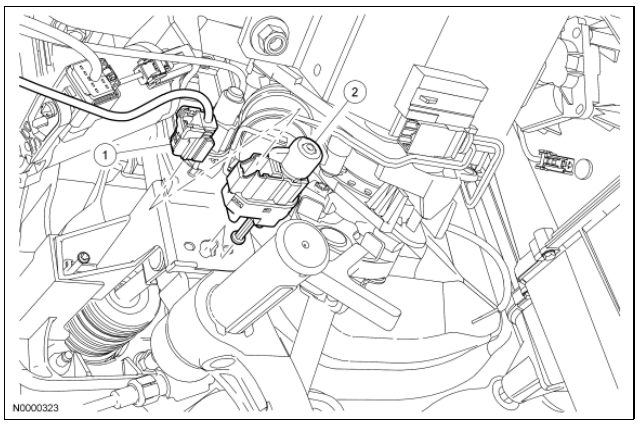
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the 3 nuts and the fog lamp.
   - Disconnect the electrical connector.
   - To install, tighten to 5 Nm (44 lb-in).

3. To install, reverse the removal procedure.

Stoplamp Switch



Item	Part Number	Description
1	14A005	Stoplamp switch electrical connector
2	13480	Stoplamp switch

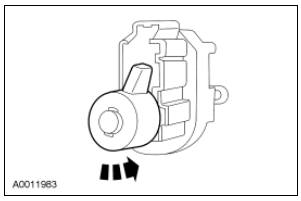
Removal

1. Disconnect the electrical connector and remove the stoplamp switch.

Installation

⚠ CAUTION: Initial installation of the stoplamp switch allows for one adjustment. If additional adjustments are required, install a new stoplamp switch.

1. To unlock, rotate the knob counterclockwise to the stop.

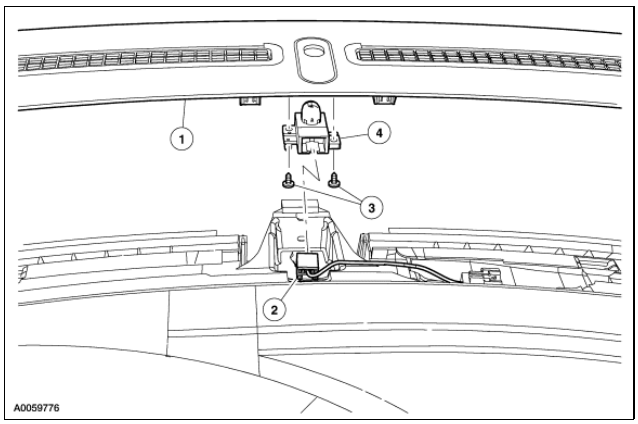


2. With the engine running, fully depress the brake pedal.

3. Install the stoplamp switch and slowly release the brake pedal.

4. Connect the stoplamp switch electrical connector.

Light Sensor



Item	Part Number	Description
1	54044E82	Instrument panel defroster grille
2	19A657	Light sensor electrical connector
3	A2906	Light sensor screws (2 required)
4	14A597	Photocell

Removal and Installation

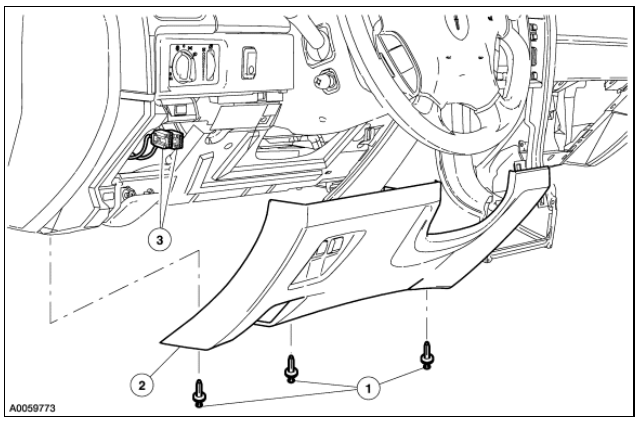
1. Remove the LH and RH windshield side garnish mouldings. For additional information, refer to Section 501-05 .

2. Remove the instrument panel defroster grille.
   - Disconnect the electrical connector.

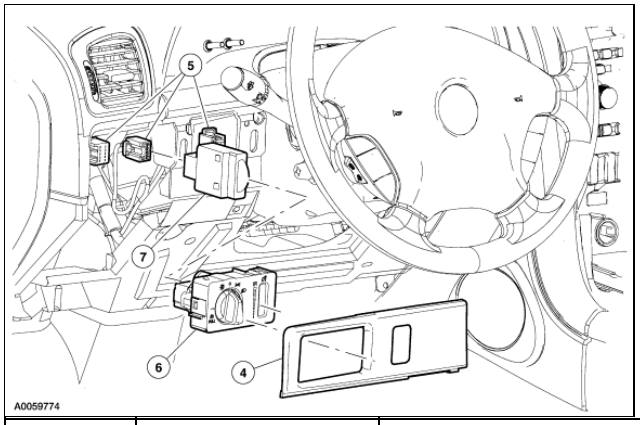
3. Remove the 2 screws and the light sensor.

4. To install, reverse the removal procedure.

Headlamp Switch



Item	Part Number	Description
1	—	Instrument panel steering column cover pin-type retainers (3 required)
2	04459	Instrument panel steering column cover
3	14401	Electrical connectors



Item	Part Number	Description
4	54044B89	Outer instrument panel finish panel
5	14401	Headlamp switch electrical connectors
6	13K196	Headlamp switch
7	13K196	Dimmer switch

Removal and Installation

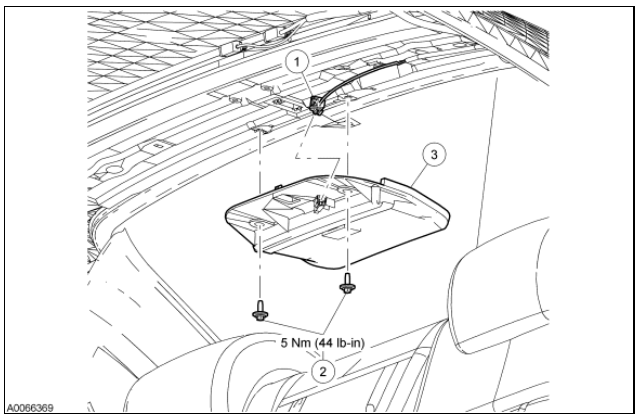
1. Remove the 3 pin-type retainers and the instrument panel steering column cover.

2. Remove the outer instrument panel finish panel.
   - Disconnect the electrical connectors.

3. Remove the headlamp switch.

4. To install, reverse the removal procedure.

High Mounted Stoplamp



Item	Part Number	Description
1	14A005	High mounted stoplamp electrical connector
2	W706681	High mounted stoplamp screws (2 required)
3	13A613	High mounted stoplamp

Removal and Installation

1. Remove the rear seat bolsters. For additional information, refer to Section 501-10 .

2. Position the rear quarter trim panels aside.

3. Remove the rear passenger assist handles.

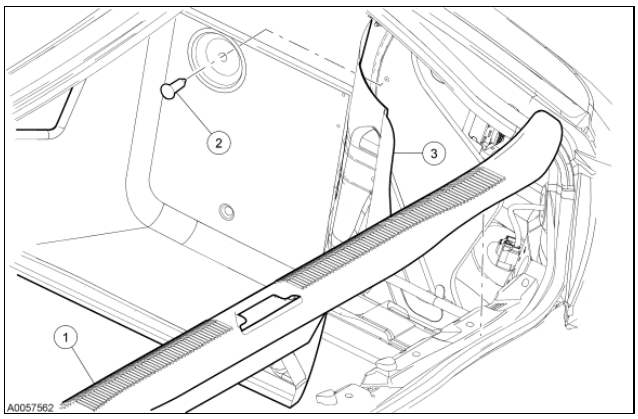
⚠ CAUTION: Do not excessively lower the rear portion of the headliner. This can create creases or kinks in the headliner.

4. Position the headliner aside.

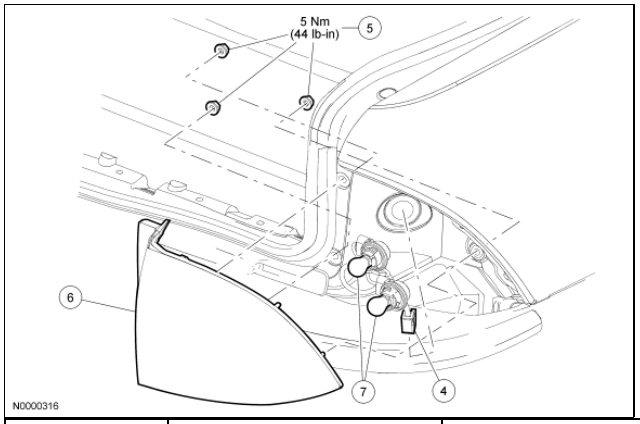
5. Remove the 2 screws and the high mounted stoplamp.
   - Disconnect the electrical connector.
   - To install, tighten to 5 Nm (44 lb-in).

6. To install, reverse the removal procedure.

Rear Lamp Assembly



Item	Part Number	Description
1	54406A64	Luggage compartment scuff plate
2	—	Pin-type retainer
3	5445422	Luggage compartment side trim panel



Item	Part Number	Description
4	13A409	Rear lamp electrical connector
5	N621925	Rear lamp nuts (3 required)
6	13B504	Rear lamp
7	13A409	Rear lamp bulbs

Removal and Installation

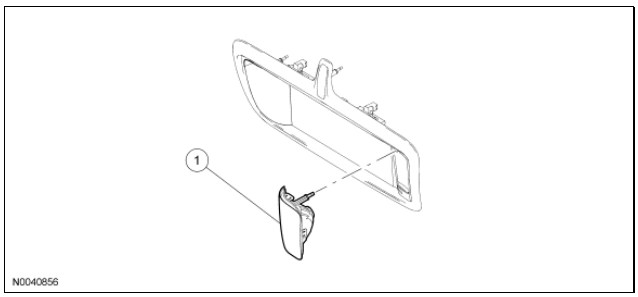
1. Remove the luggage compartment scuff plate.

2. Remove the pin-type retainer and position the luggage compartment side trim panel aside.

3. Remove the 3 nuts and the rear lamp assembly.
   - Remove the bulb sockets from the rear lamp assembly.
   - To install, tighten to 5 Nm (44 lb-in).

4. To install, reverse the removal procedure.

Reversing Lamp Assembly



Item	Part Number	Description
1	15500	Reversing lamp assembly

Removal and Installation

1. Remove the license plate housing. For additional information, refer to Section 501-00 .
2. Release the tabs and remove the reversing lamp assembly.
3. To install, reverse the removal procedure.

Interior Lighting

The interior lighting system consists of 2 subsystems:

- Interior lamps
- Demand lamps

The interior lamps are controlled by the front electronics module (FEM). The interior lamp subsystem consists of the left and right puddle lamps, footwell lamps, map lamps and the grab handle lamps. The FEM controls the interior lamps by providing the ground circuit when a door ajar is detected.

The demand lamps subsystem consists of the glove compartment lamp, luggage compartment lamp, front map lamps, left and right vanity mirror lamps and the rear grab handle reading lamps. Each of these lamps are switched individually and share a common ground circuit.

Both subsystems use the same power supply circuit through switched system power (SSP) relay 3, with the exception of the luggage compartment lamp which is powered through SSP relay 4.

Interior Lighting

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Principles of Operation

NOTE: A new front electronic module (FEM) or rear electronic module (REM) must be reconfigured before installing. For additional information, refer to Section 418-01 .

The electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician, it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- whether the module which received the input (message) controls the output of the feature, or whether it outputs a message over the SCP communication network to another module.
- which module controls the output of the feature.

FEM Operation

This system is unique in that many of the inputs the FEM receives are delivered via the SCP communication network. These input messages come from other modules connected to the network, such as the REM, driver door module (DDM), and instrument cluster. The FEM interprets the inputs and in turn, commands the correct output. The FEM also receives inputs which come directly from components hardwired to the module, such as the front door ajar switches.

Interior Lighting

The FEM controls the outputs to all interior lighting. The lamps are illuminated if any door is ajar. The front door switches are hardwired to the FEM. When either of the 2 doors is opened, the FEM commands the interior lamps on by supplying the ground circuit. The rear door ajar switches are hardwired to the REM. When any of these doors are ajar, the REM sends a command through the SCP network to the FEM. The FEM then commands the appropriate interior lamps on.

Fault management of the interior lamps provides limited functionality in the event of certain dome or lighting mode inputs, vehicle speed or ignition switch failures. All interior lighting is powered by the switched system power (SSP) feature (see below). A failure of any or all of the SSP feature(s) could cause inoperative interior lighting. When diagnosing the interior lighting, it is essential to determine if all relative symptoms and DTCs are controlled by the SSP feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in the sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (inputs) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. Each relay, when energized, will supply power to multiple features/functions. For additional information, refer to the Switched System Power (SSP) Relay Index for diagnosis and testing of SSP-related issues.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect the following for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Wiring harness • Loose or corroded connections • Battery junction box (BJB) fuses: ♦ 4 (10A) ♦ 5 (10A) ♦ 23 (30A) ♦ 24 (30A) ♦ 25 (40A) ♦ 27 (30A) ♦ 32 (30A) • Central junction box (CJB) fuse 20 (10A) • Lamp(s) • Relay(s) • Headlamp switch • Instrument cluster • Dimmer switch • Front electronic module (FEM) • Rear electronic module (REM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP+, SCP-, ISO, CAN or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for FEM, refer to Section 419-10 .
    - No response/not equipped for REM, refer to Section 419-10 .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM and REM.

7. If the DTCs retrieved are related to the concern, go to Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index or Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	GO to Pinpoint Test C .
B1327	Passenger Door Ajar Circuit Failure	FEM	GO to Pinpoint Test C .
B1342	ECU Is Defective	FEM	CLEAR the DTC. REPEAT the FEM self-test. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .

Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B2245	Passenger Rear Door Ajar Circuit Open	REM	GO to Pinpoint Test C .
B1331		REM	GO to Pinpoint Test E .

	Luggage Compartment Ajar Rear Door Circuit Failure		
B1342	ECU Is Defective	REM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 .
B2243	Driver Rear Door Ajar Circuit Open	REM	GO to Pinpoint Test C .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .

Switched System Power (SSP) Relay Index

Relay	Fuse	Controlled System(s)
SSP1	Battery junction box (BJB) fuse 27 (30A)	• Driver power door lock (FEM) • LH high beam headlamps (FEM) • RH front park/turn/side marker lamps (FEM) • RH low beam headlamp • Driver exterior rear view mirror • LH front park/turn/side marker lamps (FEM)
SSP2	BJB fuse 32 (30A)	• LH low beam headlamp (FEM) • RH high beam headlamps (FEM) • Passenger exterior rear view mirror (FEM) • Switch illumination backlighting
SSP3	BJB fuse 24 (30A)	• High mounted stop lamp (REM) • RH rear park/stop lamps (REM) • Reversing lamps (REM) • LH rear turn signals (REM) • Interior and demand lighting (FEM)
SSP4	BJB fuse 23 (30A)	• LH rear park/stop lamps (REM) • RH rear turn signals (REM) • All passenger door locks (REM) • License plate lamps • Luggage compartment release solenoid/switch • Fuel door release solenoid/switch • Luggage compartment lamp

When diagnosing an SSP relay, check that all systems for that relay are inoperative. Refer to Section 417-01 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Interior Lamps Are Inoperative

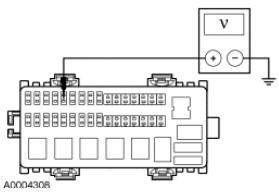
Normal Operation

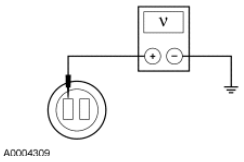
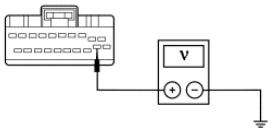
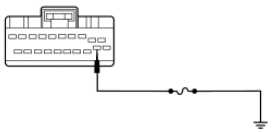
The interior lighting feature provides interior lighting whenever a door is ajar. The interior lamps are controlled through the front electronic module (FEM). The FEM provides the ground circuit for the front dome/map lamps, rear grab handle lamps, RH and LH footwell lamps and the RH and LH puddle lamps through common circuit 31S-LC3 (BK/BU). Power for the interior lamps is supplied through common circuit 29S-LB2 (OG/BU) from switched system power (SSP) relay 3.

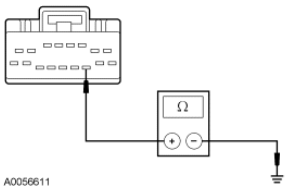
Possible Causes

- Fuse
- Circuit 29S-LC23 (OG/WH) open
- Circuit 31S-LC3 (BK/BU) short to power
- Circuit 31-DK20 (BK/RD) open
- FEM

PINPOINT TEST A: THE INTERIOR LAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
A1 CHECK CIRCUIT 30S-DB16 (RD/GN) FOR OPEN	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Remove BJB fuse 5 (10A). • Measure the voltage between the BJB fuse 5 (10A) pin 1, circuit 30S-DB16 (RD/GN), and ground.  A0004308 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL fuse 5 (10A). GO to A2 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A2 CHECK CIRCUIT 29S-LC23 (OG/WH) FOR AN OPEN	

• Disconnect: RH Footwell Lamp C266. • Measure the voltage between the RH footwell lamp C266-2, circuit 29S-LC23 (OG/WH), harness side and ground.  A0004309 • **Is the voltage greater than 10 volts?**	**Yes** RECONNECT C266. GO to A3 . **No** VERIFY the BJB fuse 5 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A3 CHECK CIRCUIT 31S-LC3 (BK/BU) FOR A SHORT TO POWER	
• Ignition OFF. • Remove BJB fuse 5 (10A). • Disconnect: FEM C201f. • Measure the voltage between the FEM C201f-12, circuit 31S-LC3 (BK/BU), harness side and ground.  A0005552 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to A4 .
A4 CHECK THE FEM FOR OPENS	
• Install the BJB fuse 5 (10A). • Ignition ON. • Connect a 30A fused jumper between the FEM C201f-12, circuit 31S-LC3 (BK/BU), harness side and ground.  A0004310 • **Did the interior lamps illuminate?**	**Yes** GO to A5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A5 CHECK CIRCUIT 31-DK20 (BK/RD) FOR AN OPEN	

• Ignition OFF. • Disconnect: FEM C201a. • Measure the resistance between the FEM C201a-11, circuit 31-DK20 (BK/RD) harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to A6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A6 CHECK FOR CORRECT FEM OPERATION	
• Disconnect all FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Interior Lamps Do Not Turn On With One Door Open

Normal Operation

The interior lighting feature provides interior lighting whenever a door is ajar. The interior lamps are controlled through the front electronic module (FEM). The FEM provides the ground circuit for the front dome/map lamps, rear grab handle lamps, RH and LH footwell lamps and the RH and LH puddle lamps through common circuit 31S-LC3 (BK/BU). Power for the interior lamps is supplied through common circuit 29S-LB2 (OG/BU) from switched system power (SSP) relay 3. The LH and RH dome/map lamps and LH and RH grab handle lamps share a common power supply splice from circuit 29S-LB2 (OG/BU) and a common ground circuit splice to circuit 9-LB1 (BN/RD). The LH and RH puddle lamps and LH and RH footwell lamps are supplied power from circuit 29S-LB2 (OG/BU) through the central junction box (CJB). All interior lamp ground circuits connect at the auxiliary junction box (AJB) and combine into one common ground circuit 29S-LC3 (BK/OG).

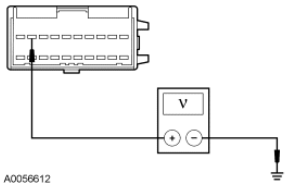
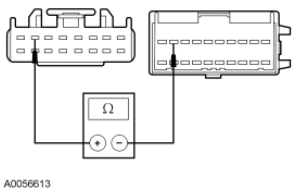
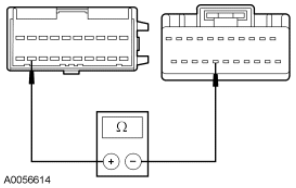
Possible Causes

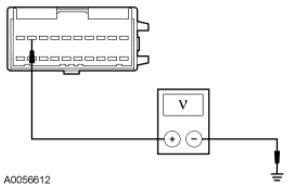
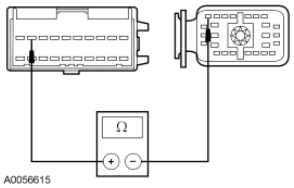
- Fuse
- Individual interior lamp
- LH map lamp switch
- RH map lamp switch
- LH rear grab handle lamp assembly
- RH rear grab handle lamp assembly
- LH instrument panel junction block
- RH instrument panel junction block
- AJB
- CJB
- FEM
- Circuit 29S-LC34 (OG/YE) open

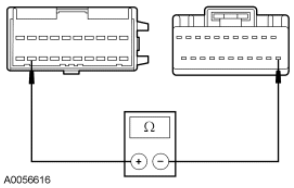
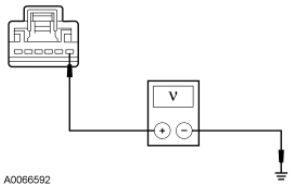
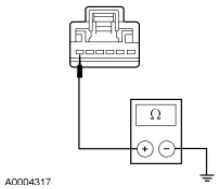
- Circuit 9-LC34 (BN) open
- Circuit 29S-LC36 (OG/YE) open
- Circuit 9-LC36 (BN) open
- Circuit 9-LB13 (BN/RD) open
- Circuit 29S-LB12 (OG/YE) open
- Circuit 31S-LB12 (BK/YE) open
- Circuit 9-LB20 (BN/BU) open
- Circuit 29S-LB19 (OG/BU) open
- Circuit 31S-LB19 (BK/BU) open
- Circuit 29S-LB14 (OG) open
- Circuit 9-LB14 (BN/BU) open
- Circuit 29S-LB21 (OG/BK) open
- Circuit 9-LB21 (BN/GN) open
- Circuit 29S-LC11 (OG/WH) open
- Circuit 31S-LC11 (BK/WH) open
- Circuit 29S-LC23 (OG/WH) open
- Circuit 31S-LC23 (BK/WH) open
- Circuit 31S-LC4 (BK/GN) open
- Circuit 29S-LC1 (OG/YE) open
- Circuit 29S-LC5 (OG/GN) open
- Circuit 9-LB1 (BN) open
- Circuit 31-DK20 (BK/RD) open

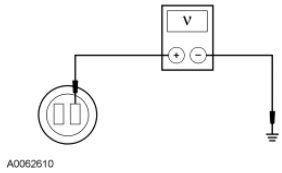
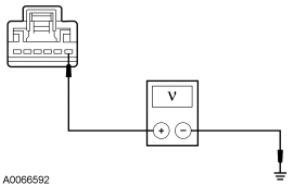
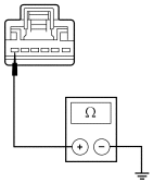
PINPOINT TEST B: THE INTERIOR LAMPS DO NOT TURN ON WITH ONE DOOR OPEN

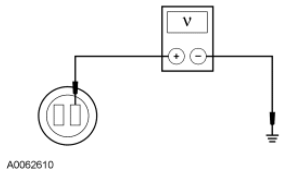
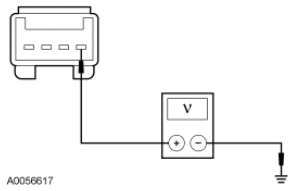
Test Step	Result / Action to Take
B1 VERIFY THE INTERIOR LAMP SYMPTOM	
• Verify the interior lamp symptom. • **Is more than one lamp inoperative?**	**Yes** GO to B28 . **No** If a puddle lamp is inoperative, GO to B2 . If a map lamp is inoperative, GO to B9 . If a rear grab handle lamp is inoperative, GO to B16 . If a footwell lamp is inoperative, GO to B21 .
B2 VERIFY THE PUDDLE LAMP SYMPTOM	
• Verify the area of the puddle lamp symptom. • **Is the driver side puddle lamp inoperative?**	**Yes** GO to B3 . **No** GO to B6 .
B3 CHECK CIRCUIT 29S-LC34 (OG/YE) FOR VOLTAGE	

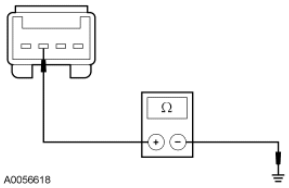
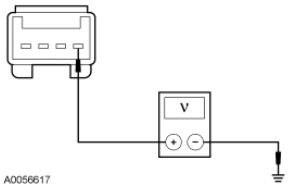
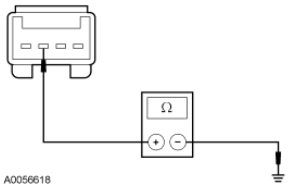
NOTE: The ignition switch must be cycled from OFF to ON to enable the switched system power feature. The switched system power will remain active for one half-hour after the ignition is turned OFF. Refer to Principles of Operation for switched system power operation. • Ignition ON. • Disconnect: Driver Side Puddle Lamp C520. • Measure the voltage between the driver side puddle lamp C520-2, circuit 29S-LC34 (OG/YE), harness side and ground.  A0056612 • **Is the voltage greater than 10 volts?**	**Yes** GO to B5 . **No** GO to B4 .
B4 CHECK CIRCUIT 29S-L34 (OG/YE) FOR AN OPEN	
• Ignition OFF. • Disconnect: AJB C283b. • Measure the resistance between the AJB C283b-7, circuit 29S-LC34 (OG/YE), harness side and the driver side puddle lamp C520-2, circuit 29S-LC34 (OG/YE) harness side.  A0056613 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new AJB. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B5 CHECK CIRCUIT 9-LC34 (BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: FEM C201b. • Measure the resistance between the FEM C201b-18, circuit 9-LC34 (BN), harness side and the driver side puddle lamp C520-12, circuit 9-LC34 (BN) harness side.  A0056614	**Yes** GO to B38 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

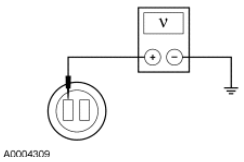
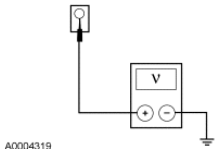
• **Is the resistance less than 5 ohms?**	
B6 CHECK CIRCUIT 29S-LC36 (OG/YE) FOR VOLTAGE	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Ignition ON. • Disconnect: Passenger Side Puddle Lamp C601. • Measure the voltage between the passenger side puddle lamp C601-2, circuit 29S-LC36 (OG/YE), harness side and ground.  A0056612 • **Is the voltage greater than 10 volts?**	**Yes** GO to B8 . **No** GO to B7 .
B7 CHECK CIRCUIT 29S-LC36 (OG/YE) FOR AN OPEN	
• Ignition OFF. • Disconnect: CJB C270d. • Measure the resistance between the CJB C270d-20, circuit 29S-LC36 (OG/YE), harness side and the passenger side puddle lamp C601-2, circuit 29S-LC36 (OG/YE) harness side.  A0056615 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new CJB. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B8 CHECK CIRCUIT 9-LC36 (BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: FEM C201b. • Measure the resistance between the FEM C201b-12, circuit 9-LC36 (BN), harness side and the passenger side puddle lamp C601-12, circuit 9-LC36 (BN), harness side.	**Yes** GO to B38 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

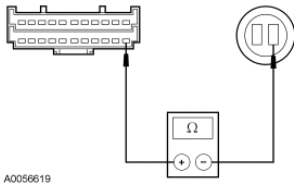
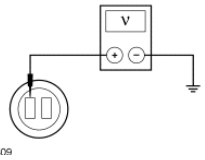
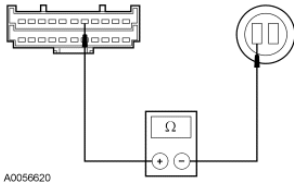
 A0056616 • **Is the resistance less than 5 ohms?**	
B9 VERIFY THE INTERIOR MAP LAMP SYMPTOM	
• Verify the area of the interior map lamp symptom. • **Is the LH map lamp inoperative?**	**Yes** GO to B10 . **No** GO to B13 .
B10 CHECK THE LH MAP LAMP SWITCH FOR VOLTAGE	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Ignition ON. • Disconnect: LH Front Map Reading Lamp Switch C910. • Measure the voltage between the LH front map reading lamp switch C910-1, circuit 31S-LB12 (BK/YE), harness side and ground.  A0066592 • **Is the voltage greater than 10 volts?**	**Yes** GO to B11 . **No** GO to B12 .
B11 CHECK CIRCUIT 9-LB13 (BN/RD) FOR AN OPEN	
• Measure the resistance between the LH map lamp switch C910-6, circuit 9-LB13 (BN/RD), harness side and ground.  A0004317 • Open the driver door. • **When the driver door is opened, does resistance drop to less than 5 ohms?**	**Yes** INSTALL a new front map lamp assembly. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B12 CHECK CIRCUITS 29S-LB12 (OG/YE) AND 31S-LB12 (BK/YE) FOR AN OPEN	

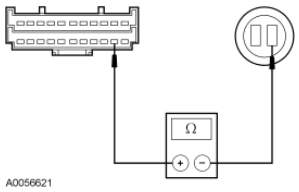
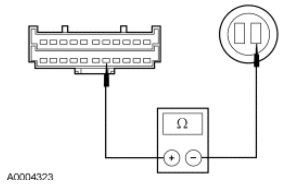
• Disconnect: LH Front Map Lamp C908. • Measure the voltage between the LH front map lamp bulb C908-2, circuit 29S-LB12 (OG/YE), harness side and ground.  A0062610 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit 31S-LB12 (BK/YE). CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 29S-LB12 (OG/YE). CLEAR the DTCs. REPEAT the self-test.
B13 CHECK THE RH MAP LAMP SWITCH FOR VOLTAGE	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Disconnect: RH Front Map Lamp Switch C905. • Ignition ON. • Measure the voltage between the RH front map lamp switch C905-1, circuit 31S-LB19 (BK/BU), harness side and ground.  A0066592 • **Is the voltage greater than 10 volts?**	**Yes** GO to B14 . **No** GO to B15 .
B14 CHECK CIRCUIT 9-LB20 (BN/BU) FOR AN OPEN	
• Measure the resistance between the RH front map lamp switch C905-6, circuit 9-LB20 (BN/BU), harness side and ground.  A0004317 • Open the driver door. • **When the driver door is opened, does resistance drop to less than 5 ohms?**	**Yes** INSTALL a new front map lamp assembly. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B15 CHECK CIRCUITS 29S-LB19 (OG/BU) AND 31S-LB19	

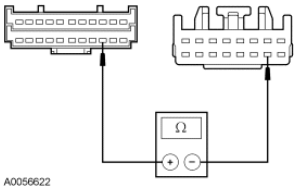
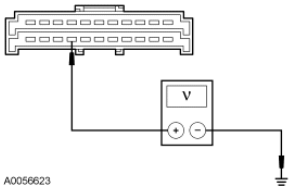
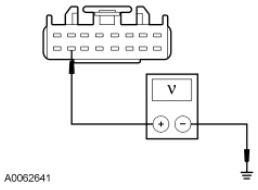
(BK/BU) FOR AN OPEN	
• Disconnect: RH Front Map Lamp C903. • Measure the voltage between the RH front map lamp C903-2, circuit 29S-LB19 (OG/BU), harness side and ground.  A0062610 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit 31S-LB19 (BK/BU). CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 29S-LB19 (OG/BU). CLEAR the DTCs. REPEAT the self-test.
B16 VERIFY THE GRAB HANDLE INTERIOR LAMP SYMPTOM	
• Verify the area of the rear grab handle interior lamp symptom. • **Is the LH rear grab handle interior lamp inoperative?**	**Yes** GO to B17 . **No** GO to B19 .
B17 CHECK CIRCUIT 29S-LB14 (OG)	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Disconnect: LH Rear Grab Handle Lamp C9009. • Ignition ON. • Measure the voltage between the LH rear grab handle lamp C9009-1, circuit 29S-LB14 (OG) harness side and ground.  A0056617 • **Is the voltage greater than 10 volts?**	**Yes** GO to B18 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B18 CHECK CIRCUIT 9-LB14 (BN/BU) FOR AN OPEN	
• Measure the resistance between the LH rear grab handle lamp C9009-3, circuit 9-LB14 (BN/BU) harness side and ground.	**Yes** INSTALL a new LH rear grab handle lamp assembly. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 9-LB14 (BN/BU). CLEAR the DTCs. REPEAT the

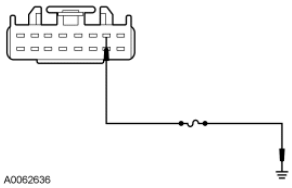
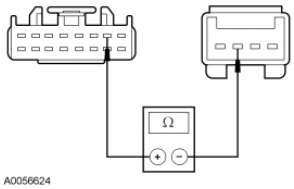
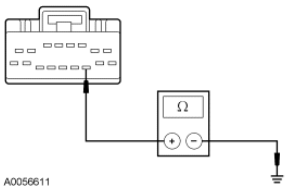
 A0056618 • Open the driver door. • **When the driver door is opened, does the resistance drop to less than 5 ohms?**	self-test.
B19 CHECK CIRCUIT 29S-LB21 (OG/BK)	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Disconnect: RH Rear Grab Handle Lamp C9010. • Ignition ON. • Measure the voltage between the RH rear grab handle lamp C9010-1, circuit 29S-LB21 (OG/BK) harness side and ground.  A0056617 • **Is the voltage greater than 10 volts?**	**Yes** GO to B20 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B20 CHECK CIRCUIT 9-LB21 (BN/GN) FOR AN OPEN	
• Measure the resistance between the RH rear grab handle lamp C9010-3, circuit 9-LB21 (BN/GN) harness side and ground.  A0056618 • Open the driver door. • **When the driver door is opened, does the resistance drop to less than 5 ohms?**	**Yes** INSTALL a new RH rear grab handle lamp assembly. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 9-LB21 (BN/GN). CLEAR the DTCs. REPEAT the self-test.
B21 VERIFY THE INTERIOR FRONT FOOTWELL LAMP SYMPTOM	
• Verify the area of the front footwell interior lamp symptom. • **Are both front footwell lamps inoperative?**	**Yes** GO to B28 . **No** If the LH footwell lamp is

	inoperative, GO to B22 . If the RH footwell lamp is inoperative, GO to B25 .
B22 CHECK CIRCUIT 29S-LC11 (OG/WH) FOR VOLTAGE	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Ignition ON. • Disconnect: LH Front Footwell Lamp C209. • Measure the voltage between the LH front footwell lamp C209-2, circuit 29S-LC11 (OG/WH), harness side and ground.  A0004309 • **Is the voltage greater than 10 volts?**	**Yes** GO to B24 . **No** GO to B23 .
B23 CHECK CIRCUIT 29S-LC11 (OG/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: AJB C283d. • Measure the resistance between the LH front footwell lamp C209-2, circuit 29S-LC11 (OG/WH), harness side and the AJB C283d-15, circuit 29S-LC11 (OG/WH), harness side.  A0004319 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new AJB. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B24 CHECK CIRCUIT 31S-LC11 (BK/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: LH Instrument Panel Junction Block C224. • Measure the resistance between the LH instrument panel junction block C224-11, circuit 31S-LC11 (BK/WH), harness side and the LH front footwell lamp C209-1, circuit 31S-LC11 (BK/WH), harness side.	**Yes** REPAIR the LH instrument panel junction block, C224. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 A0056619 • **Is the resistance less than 5 ohms?**	
B25 CHECK CIRCUIT 29S-LC23 (OG/WH) FOR VOLTAGE	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Ignition ON. • Disconnect: RH Front Footwell Lamp Bulb C266. • Measure the voltage between the RH front footwell lamp C266-2, circuit 29S-LC23 (OG/WH), harness side and ground.  A0004309 • **Is the voltage greater than 10 volts?**	**Yes** GO to B27 . **No** GO to B26 .
B26 CHECK CIRCUIT 29S-LC23 (OG/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: RH Instrument Panel Junction Block C261. • Measure the resistance between the RH front footwell lamp C266-2, circuit 29S-LC23 (OG/WH), harness side and the RH instrument panel junction block C261-18, circuit 29S-LC23 (OG/WH) harness side.  A0056620 • **Is the resistance less than 5 ohms?**	**Yes** VERIFY if the glove box lamp is operating correctly. If OK, REPAIR the RH instrument panel junction block, C261. CLEAR the DTCs. REPEAT the self-test. If the glove box lamp is not operating correctly, GO to B28 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B27 CHECK CIRCUIT 31S-LC23 (BK/WH) FOR AN OPEN	

• Ignition OFF. • Disconnect: LH Instrument Panel Junction Block C224. • Measure the resistance between the LH instrument panel junction block C224-10, circuit 31S-LC23 (BK/WH), harness side and the RH front footwell lamp C266-1, circuit 31S-LC23 (BK/WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the LH instrument panel junction block, C224. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B28 CHECK THE LH AND RH PUDDLE LAMPS	
• Verify the symptom. • **Are both puddle lamps inoperative?**	**Yes** INSTALL a new CJB. CLEAR the DTCs. REPEAT the self-test. **No** GO to B29 .
B29 CHECK THE LH AND RH FRONT FOOTWELL LAMPS	
• Verify the symptom. • **Are both front footwell interior lamps inoperative?**	**Yes** GO to B30 . **No** GO to B32 .
B30 CHECK VOLTAGE TO THE AJB	
• Disconnect: AJB C283d. • Measure the voltage between the AJB C283d-10, circuit 31S-LC4 (BK/BU), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new AJB. CLEAR the DTCs. REPEAT the self-test. **No** GO to B31 .
B31 CHECK CIRCUIT 31S-LC4 (BK/GN) FOR AN OPEN	
• Disconnect: LH Instrument Panel Junction Block C224. • Measure the resistance between the LH instrument panel junction block C224-9, circuit 31S-LC4 (BK/BU), harness side and the AJB C283d-10, circuit 31S-LC4 (BK/BU), harness side.	**Yes** REPAIR LH instrument panel junction block. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 A0056622 • **Is the resistance less than 5 ohms?**	
B32 CHECK THE RH FRONT FOOTWELL LAMP AND THE GLOVE BOX LAMP	
• Verify the symptom. • **Are the RH front footwell and the glove box lamps the only lamps that are inoperative?**	**Yes** GO to B33 . **No** GO to B34 .
B33 CHECK CIRCUIT 29S-LC1 (OG/YE)	
• Disconnect: RH Instrument Panel Junction Block C261. • Ignition ON. • Measure the voltage between the RH instrument panel junction block C261-19, circuit 29S-LC1 (OG/BU), harness side and ground.  A0056623 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR RH instrument panel junction block. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 29S-LC1 (OG/YE). CLEAR the DTCs. REPEAT the self-test.
B34 CHECK THE LH FOOTWELL LAMP AND THE LH PUDDLE LAMP	
• Verify the symptom. • **Are the LH footwell and the LH puddle lamps the only lamps that are inoperative?**	**Yes** GO to B35 . **No** GO to B36 .
B35 CHECK CIRCUIT 29S-LC5 (OG/GN)	
• Disconnect: AJB C283b. • Ignition ON. • Measure the voltage between the AJB C283b-15, circuit 29S-LC5 (OG/GN), harness side and ground.  A0062641	**Yes** INSTALL a new AJB. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

• **Is the voltage greater than 10 volts?**	
B36 CHECK BOTH MAP AND BOTH GRAB HANDLE LAMPS OPERATION AT THE AJB	
• Disconnect: AJB C283a. • Connect a 10A fused jumper between the AJB C283a-2, circuit 9-LB1 (BN), harness side and ground.  A0062636 • **Do both map and both rear grab handle lamps illuminate?**	**Yes** INSTALL a new AJB. CLEAR the DTCs. REPEAT the self-test. **No** GO to B37 .
B37 CHECK CIRCUIT 9-LB1 (BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: LH Rear Grab Handle Lamp C9009. • Measure the resistance between the LH rear grab handle lamp C9009-3, circuit 9-LB14 (BN/BU), harness side and the AJB C283a-2, circuit 9-LB1 (BN), harness side.  A0056624 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit 29S-LB2 (OG/BU). CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit 9-LB1 (BN). CLEAR the DTCs. REPEAT the self-test.
B38 CHECK CIRCUIT 31-DK20 (BK/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: FEM C201a. • Measure the resistance between the FEM C201a-11, circuit 31-DK20 (BK/RD) harness side and ground.  A0056611 • **Is the resistance less than 5 ohms?**	**Yes** GO to B39 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B39 CHECK FOR CORRECT FEM OPERATION	
• Disconnect all FEM connectors. • Check for:	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system

♦ corrosion ♦ pushed-out pins • Connect all FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The Interior Lamps Stay On Continuously

Normal Operation

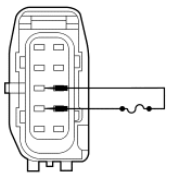
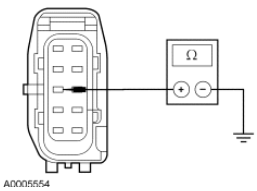
The interior lighting feature provides interior lighting whenever a door is ajar. The interior lamps are controlled through the front electronic module (FEM). The FEM provides the ground circuit for the front dome/map lamps, rear grab handle lamps, RH and LH footwell lamps and the RH and LH puddle lamps through common circuit 31S-LC3 (BK/BU). Power for the interior lamps is supplied through common circuit 29S-LB2 (OG/BU) from switched system power (SSP) relay 3. The LH and RH dome/map lamps and LH and RH grab handle lamps share a common power supply splice from circuit 29S-LB2 (OG/BU) and a common ground circuit splice to circuit 9-LB1 (BN). The LH and RH puddle lamps and LH and RH footwell lamps are supplied power from circuit 29S-LB2 (OG/BU) through the central junction box (CJB). All interior lamp ground circuits connect at the auxiliary junction box (AJB) and combine into one common ground circuit 29S-LC3 (OG).

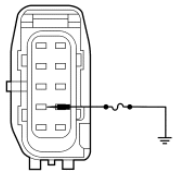
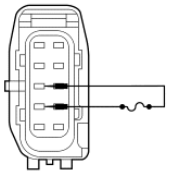
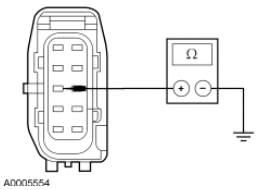
Possible Causes

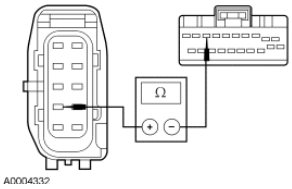
- Driver door ajar switch
- Passenger door ajar switch
- LH rear passenger door ajar switch
- RH rear passenger door ajar switch
- Map lamp switches
- Rear grab handle lamp switches
- FEM
- Rear electronic module (REM)
- Circuit 31-AA58 (BK) open
- Circuit 31S-GL46 (BK/YE) open
- Circuit 31S-GL47 (BK/BU) open
- Circuit 31S-GL12 (BK/OG) short to ground
- Circuit 31S-GL19 (BK/GN) short to ground
- Circuit 31S-LC3 (BK/BU) short to ground
- Circuit 9-LC34 (BN) short to ground
- Circuit 9-LB1 (BN) short to ground

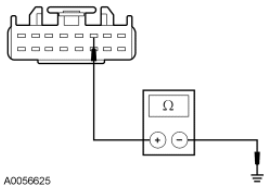
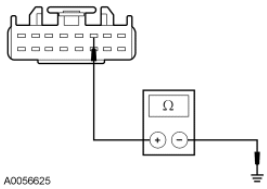
PINPOINT TEST C: THE INTERIOR LAMPS STAY ON CONTINUOUSLY

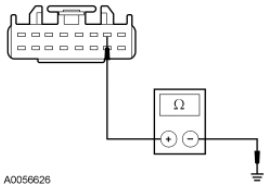
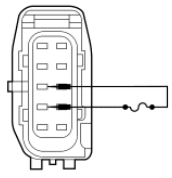
Test Step	Result / Action to Take
C1 USE THE RECORDED RESULTS FROM THE FEM SELF-TESTS	
• Use the recorded FEM continuous and self-test DTCs. • **Are any DTCs recorded?**	**Yes** If DTC B1319, GO to C3 . If DTC B1327, GO to C6 .

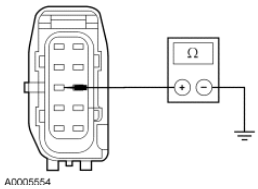
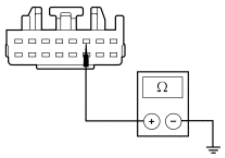
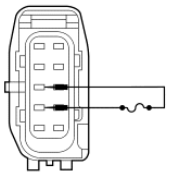
	For all other DTCs, REFER to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index in this section. **No** GO to C2 .
C2 USE THE RECORDED RESULTS FROM THE REM SELF-TESTS	
• Use the recorded REM continuous and self-test DTCs. • **Are any DTCs recorded?**	**Yes** If DTC B1335, GO to C20 . If DTC B1571, GO to C23 . For all other DTCs, REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index in this section. **No** GO to C9 .
C3 CHECK THE DRIVER DOOR AJAR SWITCH	
• Ignition OFF. • Disconnect: Driver Door Lock Actuator C525. • Connect a fused jumper wire between the driver door lock actuator C525-6, circuit 31-AA58 (BK), harness side and the C525-8, circuit 31S-GL46 (BK/YE), harness side.  A0005553 • **Did the interior lamps turn off after 20-30 seconds?**	**Yes** INSTALL a new driver door lock actuator/ajar switch. REFER to Section 419-01B . CLEAR the DTCs. REPEAT the self-test. **No** GO to C4 .
C4 CHECK CIRCUIT 31-AA58 (BK) FOR AN OPEN	
• Measure the resistance between the driver door lock actuator C525-6, circuit 31-AA58 (BK), harness side and ground.  A0005554 • **Is the resistance less than 5 ohms?**	**Yes** GO to C5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

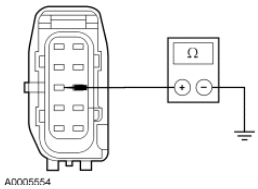
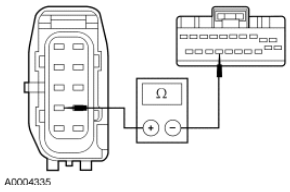
C5 CHECK CIRCUIT 31S-GL46 (BK/YE) FOR AN OPEN	
• Disconnect: FEM C201f. • Measure the resistance between the driver door lock actuator C525-8, circuit 31S-GL46 (BK/YE), harness side and the FEM C201f-8, circuit 31S-GL46 (BK/YE), harness side.  A0004331 • **Is the resistance less than 5 ohms?**	**Yes** GO to C26 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C6 CHECK THE FRONT PASSENGER DOOR AJAR SWITCH	
• Ignition OFF. • Disconnect: Front Passenger Door Lock Actuator C609. • Connect a fused jumper wire between the front passenger door lock actuator C609-6, circuit 31-AA58 (BK), harness side and the C609-8, circuit 31S-GL47 (BK/BU), harness side.  A0005553 • **Did the interior lamps turn off after 20-30 seconds?**	**Yes** INSTALL a new passenger door lock actuator/ajar switch. REFER to Section 419-01B . CLEAR the DTCs. REPEAT the self-test. **No** GO to C7 .
C7 CHECK CIRCUIT 31-AA58 (BK) FOR AN OPEN	
• Measure the resistance between the front passenger door lock actuator C609-6, circuit 31-AA58 (BK), harness side and ground.  A0005554 • **Is the resistance less than 5 ohms?**	**Yes** GO to C8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C8 CHECK CIRCUIT 31S-GL47 (BK/BU) FOR AN	

OPEN	
• Ignition OFF. • Disconnect: FEM C201e. • Measure the resistance between the front passenger door lock actuator C609-8, circuit 31S-GL47 (BK/BU), harness side and the FEM C201e-15, circuit 31S-GL47 (BK/BU), harness side.  A0004332 • **Is the resistance less than 5 ohms?**	**Yes** GO to C26 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C9 CHECK THE LH FRONT MAP READING LAMP OPERATION	
• Ignition ON. • Activate the LH front map reading lamp demand switch. • **Do all other interior lamps turn off?**	**Yes** GO to C12 . **No** GO to C10 .
C10 CHECK THE RH FRONT MAP READING LAMP OPERATION	
• Activate the RH front map lamp switch. • **Do all other interior lamps turn off?**	**Yes** GO to C13 . **No** GO to C11 .
C11 CHECK THE LH GRAB HANDLE LAMP SWITCH OPERATION	
• Activate the LH rear grab handle lamp switch. • **Do all other interior lamps turn off?**	**Yes** INSTALL a new LH rear grab handle lamp assembly. CLEAR the DTCs. REPEAT the self-test. **No** GO to C14 .
C12 CHECK CIRCUIT 31S-LB12 (BK/YE) FOR A SHORT TO GROUND	
• Disconnect: LH Front Map Reading Lamp Switch C910. • **Does the LH front map lamp stay on?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new front map lamp assembly. CLEAR the DTCs. REPEAT the self-test.
C13 CHECK CIRCUIT 31S-LB19 (BK/BU) FOR A SHORT TO GROUND	

• Disconnect: RH Front Map Reading Lamp Switch C905. • **Does the RH front map lamp stay on?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new front map lamp assembly. CLEAR the DTCs. REPEAT the self-test.
C14 CHECK THE RH GRAB HANDLE LAMP SWITCH OPERATION	
• Activate the RH rear grab handle lamp switch. • **Do all other interior lamps turn off?**	**Yes** INSTALL a new RH rear grab handle lamp assembly. CLEAR the DTCs. REPEAT the self-test. **No** GO to C15 .
C15 ISOLATE CIRCUIT 31S-LC3 (BK/BU) AND FEM FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: AJB C283b. • Measure the resistance between the AJB C283b-3, circuit 31S-LC3 (BK/BU), harness side and ground.  A0056625 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to C17 . **No** GO to C16 .
C16 CHECK CIRCUIT 31S-LC3 (BK/BU) FOR A SHORT TO GROUND	
• Disconnect: FEM C201f. • Measure the resistance between the AJB C283b-3, circuit 31S-LC3 (BK/BU), harness side and ground.  A0056625 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C26 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C17 CHECK CIRCUIT 9-LC34 (BN) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: AJB C283b.	**Yes** GO to C18 .

• **Are all interior lamps still on?**	**No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C18 ISOLATE THE FOOTWELL LAMP CIRCUITS FOR A SHORT TO GROUND	
• Disconnect: AJB C283d. • **Are all the interior lamps still on?**	**Yes** GO to C19 . **No** REPAIR circuit 31S-LC4 (OG/YE). CLEAR the DTCs. REPEAT the self-test.
C19 CHECK CIRCUITS 9-LB1 (BN) AND 9-LC36 (BN) FOR A SHORT TO GROUND	
• Disconnect: AJB C283a. • Measure the resistance between the AJB C283a-2, circuit 9-LB1 (BN), harness side and ground.  A0056626 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new AJB. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
C20 CHECK THE RH REAR PASSENGER DOOR AJAR SWITCH	
• Ignition OFF. • Disconnect: RH Rear Passenger Door Lock Actuator C804. • Connect a fused jumper wire between the RH rear passenger door lock actuator C804-6, circuit 31-AA58 (BK), harness side and the C804-8, circuit 31S-GL19 (BK/GN), harness side.  A0005553 • **Did the interior lamps turn off after 20-30 seconds?**	**Yes** INSTALL a new RH rear passenger door lock actuator/ajar switch. REFER to Section 419-01B . CLEAR the DTCs. REPEAT the self-test. **No** GO to C21 .
C21 CHECK CIRCUIT 31-AA58 (BK) FOR AN OPEN	
• Measure the resistance between the RH rear passenger door lock actuator C804-6, circuit 31-AA58 (BK), harness side and ground.	**Yes** GO to C22 . **No** REPAIR the circuit. CLEAR the DTCs.

 A0005554 • **Is the resistance less than 5 ohms?**	REPEAT the self-test.
C22 CHECK CIRCUIT 31S-GL19 (BK/GN) FOR AN OPEN	
• Disconnect: REM C420d. • Measure the resistance between the RH rear passenger door lock actuator C804-8, circuit 31S-GL19 (BK/GN), harness side and the REM C420d-17, circuit 31S-GL19 (BK/GN), harness side.  A0004334 • **Is the resistance less than 5 ohms?**	**Yes** GO to C27 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C23 CHECK THE LH REAR PASSENGER DOOR AJAR SWITCH	
• Ignition OFF. • Disconnect: LH Rear Passenger Door Lock Actuator C704. • Connect a fused jumper wire between the LH rear passenger door lock actuator C704-6, circuit 31-AA58 (BK), harness side and the C704-8, circuit 31S-GL12 (BK/OG), harness side.  A0005553 • **Did the interior lamps turn off after 20-30 seconds?**	**Yes** INSTALL a new LH rear passenger door lock actuator/ajar switch. REFER to Section 419-01B . CLEAR the DTCs. REPEAT the self-test. **No** GO to C24 .
C24 CHECK CIRCUIT 31-AA58 (BK) FOR AN OPEN	
• Measure the resistance between the LH rear passenger door lock actuator C704-6, circuit 31-AA58 (BK), harness side and ground.	**Yes** GO to C25 . **No** REPAIR circuit 31-AA58 (BK). CLEAR

 A0005554 • **Is the resistance less than 5 ohms?**	the DTCs. REPEAT the self-test.
C25 CHECK CIRCUIT 31S-GL12 (BK/OG) FOR AN OPEN	
• Disconnect: REM C420c. • Measure the resistance between the LH rear passenger door lock actuator C704-8, circuit 31S-GL12 (BK/OG), harness side and the REM C420c-16, circuit 31S-GL12 (BK/OG), harness side.  A0004335 • **Is the resistance less than 5 ohms?**	**Yes** GO to C27 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C26 CHECK FOR CORRECT FEM OPERATION	
• Disconnect all FEM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all FEM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
C27 CHECK FOR CORRECT REM OPERATION	
• Disconnect all REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Glove Compartment, LH and RH Map Lamps, LH and RH Vanity Mirror Lamps or LH and RH Grab Handle Lamps are Inoperative

Normal Operation

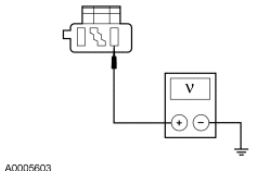
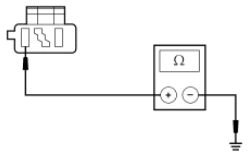
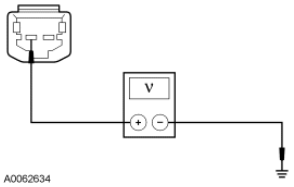
The demand lamps consist of the glove compartment lamp, LH and RH map lamps, LH and RH vanity mirror lamps and the LH and RH grab handle lamps. Switched system power (SSP) is supplied to these lamps through SSP relay 3, and circuit 29S-LB2 (OG/BU). The glove compartment lamp uses ground circuit 31-LB8 (BK/OG). All other demand lamps are spliced into a common ground circuit 31-LB3 (BK/OG).

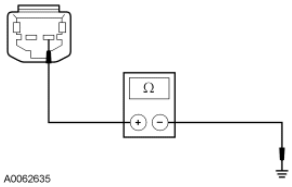
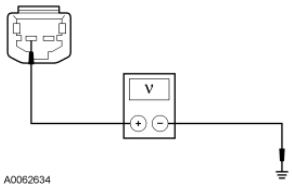
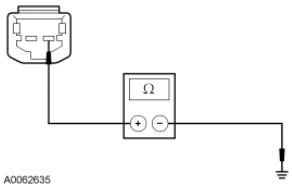
Possible Causes

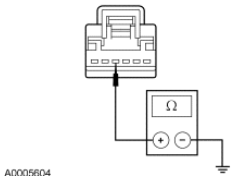
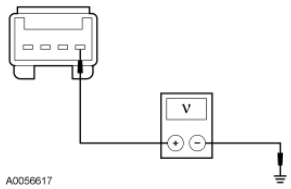
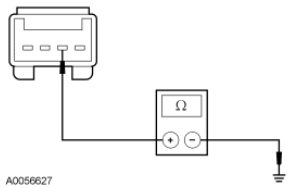
- Fuse
- Circuit 29S-LB8 (OG) open
- Circuit 31-LB8 (BK/OG) open
- Circuit 29S-LB16 (OG/GN) open
- Circuit 31-LB16 (BK/RD) open
- Circuit 29S-LB23 (OG/WH) open
- Circuit 31-LB23 (BK/WH) open
- Circuit 29S-LB14 (OG) open
- Circuit 31-LB14 (BK) open
- Circuit 29S-LB21 (OG/BK) open
- Circuit 31-LB21 (BK) open
- Individual demand lamp
- Individual demand lamp switch

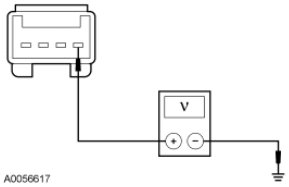
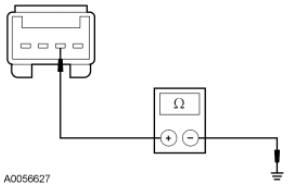
PINPOINT TEST D: THE GLOVE COMPARTMENT, LH AND RH MAP LAMPS, LH AND RH VANITY MIRROR LAMPS OR LH AND RH REAR GRAB HANDLE LAMPS ARE INOPERATIVE

Test Step	Result / Action to Take
D1 VERIFY THE LAMP SYMPTOM	
NOTE: If any of the interior lamps are also inoperative, refer to GO to Symptom Chart . If multiple lamps are inoperative, GO to Pinpoint Test C . • Verify the inoperative lamp. • **Is the glove compartment lamp inoperative?**	**Yes** GO to D2 . **No** If the LH visor lamp is inoperative, GO to D4 . If the RH visor lamp is inoperative, GO to D6 . If a map lamp is inoperative, GO to D8 . If the LH rear grab handle lamp is inoperative, GO to D9 . If the RH rear grab handle is inoperative, GO to D11 .
D2 CHECK CIRCUIT 29S-LB8 (OG) FOR AN OPEN	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation.	**Yes** GO to D3 . **No** VERIFY the battery

• Disconnect: Glove Compartment Lamp and Switch C254. • Measure the voltage between the glove compartment lamp and switch C254-1, circuit 29S-LB8 (OG), harness side and ground.  A0005603 • **Is the voltage greater than 10 volts?**	junction box (BJB) fuse 5 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D3 CHECK CIRCUIT 31-LB8 (BK/OG) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the glove compartment lamp and switch C254-2, circuit 31-LB8 (BK/OG), harness side and ground.  A0062611 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new glove compartment lamp and switch. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK CIRCUIT 29S-LB16 (OG/GN) FOR OPEN	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Disconnect: LH Vanity Mirror Lamp and Switch C907. • Measure the voltage between the LH vanity mirror lamp and switch C907-1, circuit 29S-LB16 (OG/GN), harness side and ground.  A0062634 • **Is the voltage greater than 10 volts?**	**Yes** GO to D5 . **No** VERIFY the BJB fuse 5 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D5 CHECK CIRCUIT 31-LB16 (BK/RD) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the LH vanity mirror lamp and switch C907-1, circuit 31-LB16 (BK/RD), harness side and ground.	**Yes** INSTALL a new LH vanity mirror lamp and switch. CLEAR the DTCs. REPEAT the self-test.

 A0062635 • **Is the resistance less than 5 ohms?**	**No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D6 CHECK CIRCUIT 29S-LB23 (OG/WH) FOR AN OPEN	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Ignition OFF. • Disconnect: RH Vanity Mirror Lamp and Switch C906. • Ignition ON. • Measure the voltage between the RH vanity mirror lamp and switch C906-2, circuit 29S-LB23 (OG/WH), harness side and ground.  A0062634 • **Is the voltage greater than 10 volts?**	**Yes** GO to D7 . **No** VERIFY the BJB fuse 5 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D7 CHECK CIRCUIT 31-LB23 (BK/WH) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the RH vanity mirror lamp and switch C906-1, circuit 31-LB23 (BK/WH), harness side and ground.  A0062635 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new RH vanity mirror lamp and switch. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D8 CHECK THE GROUND CIRCUIT TO THE MAP SWITCH	
• Ignition OFF. • Disconnect: Front Map Reading Lamp Switch C905 or C910. • For the LH front map reading lamp switch measure the resistance between the C910-4, circuit 31-LB13 (BK/BU), harness side and ground. For the RH front map reading lamp switch measure the resistance between the C905-4, circuit 31-LB20 (BK/OG), harness side and ground.	**Yes** INSTALL a new front map lamp assembly. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit.

 A0005604 • **Are the resistance less than 5 ohms?**	CLEAR the DTCs. REPEAT the self-test.
D9 CHECK CIRCUIT 29S-LB14 (OG) FOR AN OPEN	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Disconnect: LH Rear Grab Handle Lamp and Switch C9009. • Measure the voltage between the LH rear grab handle lamp and switch C9009-1, circuit 29S-LB14 (OG), harness side and ground.  A0056617 • **Is the voltage greater than 10 volts?**	**Yes** GO to D10 . **No** VERIFY the BJB fuse 5 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D10 CHECK CIRCUIT 31-LB14 (BK) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the LH rear grab handle lamp and switch C9009-2, circuit 31-LB14 (BK), harness side and ground.  A0056627 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new LH rear grab handle lamp and switch. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D11 CHECK CIRCUIT 29S-LB21 (OG/BK) FOR AN OPEN	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Ignition OFF. • Disconnect: RH Rear Grab Handle Lamp and Switch C9010. • Ignition ON.	**Yes** GO to D12 . **No** VERIFY the BJB fuse 5 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

• Measure the voltage between the RH rear grab handle lamp and switch C9010-1, circuit 29S-LB21 (OG/BK), harness side and ground.  A0056617 • **Is the voltage greater than 10 volts?**	
D12 CHECK CIRCUIT 31-LB21 (BK) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the RH rear grab handle lamp and switch C9010-2, circuit 31-LB21 (BK), harness side and ground.  A0056627 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new RH rear grab handle lamp and switch. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Interior Lamps Stay On Continuously — Luggage Compartment Lamp Only

Normal Operation

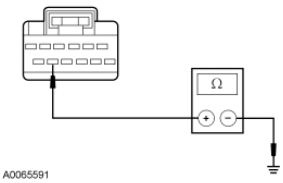
The luggage compartment lamp is controlled through the rear electronic module (REM). Switched system power (SSP) relay 4 supplies power to the lamp through circuit 29S-LB4 (OG/BK). The luggage compartment lid ajar switch provides a ground signal to the REM through circuit 8-GL20 (WH/BK) which, in turn, provides a ground signal to the luggage compartment lamp through circuit 31S-LB25 (BK/BU).

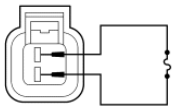
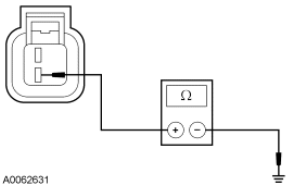
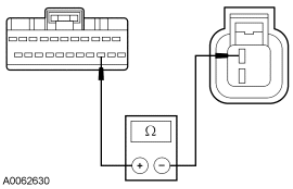
Possible Causes

- Circuit 31S-LB25 (BK/BU) short to ground
- Circuit 31-GL20 (BK/RD) open
- Circuit 8-GL20 (WH/BK) open
- Luggage compartment lid ajar switch
- REM

PINPOINT TEST E: THE INTERIOR LAMPS STAY ON CONTINUOUSLY — LUGGAGE COMPARTMENT LAMP ONLY

Test Step	Result / Action to Take
E1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs)	
• Use recorded results from REM self-test.	**Yes** If B1331, GO to E4 .

• **Are any DTCs recorded?**	For all other DTCs REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index in this section. **No** GO to E2 .
E2 CHECK THE LUGGAGE COMPARTMENT LID AJAR SWITCH INPUT TO THE REM	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Connect the scan tool. • Enter the following diagnostic mode on the scan tool: PID/DATA Record and Monitor. • While opening and closing the luggage compartment lid, monitor the REM PID DECKLID. • **Do the REM PID values agree with the luggage compartment lid positions?**	**Yes** GO to E3 . **No** GO to E4 .
E3 CHECK CIRCUIT 31S-LB25 (BK/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: REM C420a. • Disconnect: Luggage Compartment Lid Lamp C428. • Measure the resistance between the REM C420a-11, circuit 31S-LB25 (BK/BU), harness side and ground.  A0065591 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E4 CHECK THE LUGGAGE COMPARTMENT LID AJAR SWITCH	
• Disconnect: Luggage Compartment Lid Ajar Switch C429. • Connect a fused (10A) jumper wire between the luggage compartment lid ajar switch C429-1, circuit 8-GL20 (WH/BK) and C429-2, circuit 31-GL20 (BK/RD) harness side.	**Yes** INSTALL a new luggage compartment lid ajar switch. CLEAR the DTCs. REPEAT the self-test. **No** GO to E5 .

 A0062632 • **Does the luggage compartment lid lamp go off?**	
E5 CHECK CIRCUIT 31-GL20 (BK/RD) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the luggage compartment lid ajar switch C429-2, circuit 31-GL20 (BK/RD), harness side and ground.  A0062631 • **Is the resistance less than 5 ohms?**	**Yes** GO to E6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E6 CHECK CIRCUIT 8-GL20 (WH/BK) FOR AN OPEN	
• Disconnect: REM C420b. • Measure the resistance between the REM C420b-14, circuit 8-GL20 (WH/BK), harness side and the luggage compartment lid ajar switch C429-1, circuit 8-GL20 (WH/BK), harness side.  A0062630 • **Is the resistance less than 5 ohms?**	**Yes** GO to E7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E7 CHECK FOR CORRECT REM OPERATION	
• Disconnect all REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Luggage Compartment Lamp is Inoperative

Normal Operation

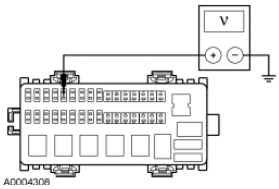
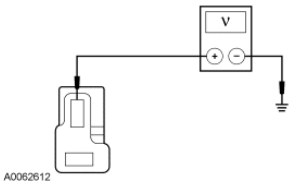
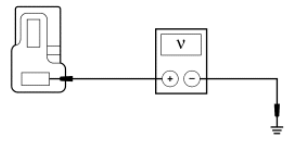
The luggage compartment lamp is controlled through the rear electronic module (REM). Switched system power (SSP) relay 4 supplies power to the lamp through circuit 29S-LB4 (OG/BK). The luggage compartment lid ajar switch provides a ground signal to the REM through circuit 8-GL20 (WH/BK) which, in turn, provides a ground signal to the luggage compartment lamp through circuit 31S-LB25 (BK/BU).

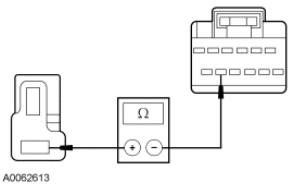
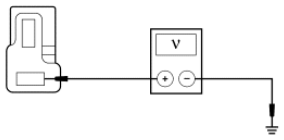
Possible Causes

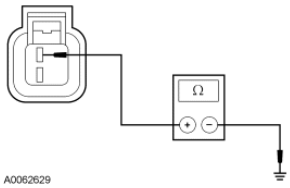
- Fuse
- Luggage compartment lid ajar switch
- BJB
- REM
- Circuit 29S-LB25 (OG/BU) open
- Circuit 31S-LB25 (BK/BU) open
- Circuit 31S-LB25 (BK/BU) short to ground
- Circuit 8-GL20 (WH/BK) short to ground

PINPOINT TEST F: THE LUGGAGE COMPARTMENT LAMP IS INOPERATIVE

Test Step	Result / Action to Take
F1 RETRIEVE THE REM DIAGNOSTIC TROUBLE CODES (DTCs)	
• Use recorded results from the REM self-test. • **Are any REM DTCs recorded?**	**Yes** REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index. **No** GO to F2 .
F2 CHECK THE LUGGAGE COMPARTMENT LID AJAR SWITCH INPUT TO THE REM	
NOTE: The ignition switch must be cycled from OFF to ON to enable the SSP feature. The SSP will remain active for one half-hour after ignition is turned off. Refer to Principles of Operation for SSP operation. • Connect the scan tool. • Enter the following diagnostic mode on the scan tool: PID/DATA Record and Monitor. • While opening and closing the luggage compartment lid, monitor the REM PID DECKLID. • **Does the REM PID values DECKLID agree with the luggage compartment lid position?**	**Yes** GO to F3 . **No** GO to F8 .
F3 CHECK THE POWER TO THE BJB FUSE 4 (10A)	

• Disconnect: BJB Fuse 4 (10A). • Ignition ON. • Measure the voltage between the BJB fuse 4 (10A) input side and ground.  A0004308 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL the BJB fuse 4 (10A) and GO to F4 . **No** REPAIR the supply circuit to the BJB. CLEAR the DTCs. REPEAT the self-test.
F4 CHECK CIRCUIT 29S-LB25 (OG/BU) FOR AN OPEN	
• Disconnect: Luggage Compartment Lid Lamp C428. • Measure the voltage between the luggage compartment lid lamp C428-1, circuit 29S-LB25 (OG/BU), harness side and ground.  A0062612 • **Is the voltage greater than 10 volts?**	**Yes** GO to F5 . **No** VERIFY the BJB fuse 4 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F5 CHECK CIRCUIT 31S-LB25 (BK/BU) FOR VOLTAGE	
• Measure the voltage between the luggage compartment lid lamp C428-2, circuit 31S-LB25 (BK/BU), harness side and ground.  A0062614 • **Is the voltage greater than 10 volts?**	**Yes** GO to F7 . **No** GO to F6 .
F6 CHECK CIRCUIT 31S-LB25 (BK/BU) FOR AN OPEN	
• Ignition OFF. • Disconnect: REM C420a. • Measure the resistance between the REM C420a-11, circuit 31S-LB25 (BK/BU), harness side and the luggage compartment lid lamp C428-2, circuit	**Yes** GO to F10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

31S-LB25 (BK/BU), harness side.  A0062613 • **Is the resistance less than 5 ohms?**	
F7 CHECK CIRCUIT 31S-LB25 (BK/BU) FOR A SHORT TO BATTERY	
• Ignition OFF. • Disconnect: REM C420b. • Ignition ON. • Measure the voltage between the luggage compartment lid lamp C428-2, circuit 31S-LB25 (BK/BU) harness side and ground.  A0062614 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to F10 .
F8 CHECK FOR A STUCK OR A STICKING LUGGAGE COMPARTMENT AJAR SWITCH	
• Ignition ON. • Disconnect: Luggage Compartment Lid Ajar Switch C429. • While disconnecting the luggage compartment lid ajar switch, observe the luggage compartment lamp. • **Does the luggage compartment lid lamp go ON?**	**Yes** INSTALL a new luggage compartment lid ajar switch. TEST the system for normal operation. **No** GO to F9 .
F9 CHECK CIRCUIT 8-GL20 (WH/BK) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: REM C420b. • Measure the resistance between the luggage compartment lid ajar switch C429-1, circuit 8-GL20 (WH/BK), harness side and ground.	**Yes** GO to F10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 • **Is the resistance greater than 10,000 ohms?**	
F10 CHECK FOR CORRECT REM OPERATION	
• Disconnect all REM connectors. • Check for: ♦ corrosion ♦ pushed-out pins • Connect all REM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Communications Network

Anti-Lock Brake System/Traction Control (ABS/TC) Module Or Stability Assist Module (if equipped)

The ABS/TC module or stability assist module (if equipped) are on the standard corporate protocol (SCP) communications network. The ABS/TC module or stability assist module controls the brake pressure to the 4 wheels to keep the vehicle under control while braking.

For additional information, refer to Section 206-09 .

Audio Control Module (ACM)

The ACM is connected to the SCP communications network and also to the audio control protocol (ACP) communications network. The ACM communicates with the compact disc player/changer using the ACP. The ACM uses the SCP communications network for diagnostics.

For additional information on the ACM and the compact disc player/changer, refer to Section 415-00 .

Driver Door Module (DDM)

The DDM is connected to the SCP communications network. The DDM accepts the user memory set and recall buttons. The DDM then sends the memory set and recall commands to the other modules over the SCP communications network. The DDM also controls the driver mirror (memory positions are stored there and manual functions are controlled there). The driver seat module (DSM) controls the driver seat. The front electronic module (FEM) controls the passenger mirror and adjustable pedals positions. The instrument cluster controls the steering column positions.

For additional information, refer to Section 419-10 .

Driver Climate Control Seat Module

The driver climate control seat module is on the universal asynchronous receiver-transmitter (UART)-based protocol (UBP) communications network. The driver climate control seat module and duel automatic temperature control (DATC) module control the heating and cooling elements in the seat for passenger comfort.

For additional driver climate control seat module information, refer to Section 501-10 .

Driver Seat Module (DSM)

The DSM is on the SCP communications network. The DSM controls the positioning and programming of the driver seat.

For additional information, refer to Section 501-10 .

Dual Automatic Temperature Control (DATC) Module

The DATC module is on the SCP communications network and the UBP communications network. The DATC module uses the SCP communications network to communicate with the diagnostic tool and other modules. The UBP communications network is used by the DATC module for communication with the driver climate control seat module. The DATC module controls automatic climate functions that maintain the vehicle interior temperature at a constant setting.

For additional information, refer to Section 412-00 .

Electric Parking Brake Module

The electric parking brake module is connected to the SCP communications network. The module controls the solenoid which applies and releases the parking brake. For additional electric parking brake module information, refer to Section 206-05 .

Front Electronic Module (FEM)/Rear Electronic Module (REM)

The FEM and REM are connected to the SCP communications network. The FEM and the REM control both interior and exterior lighting and perimeter anti-theft functions.

For additional information on interior lamps, refer to Section 417-02 .

For additional information on exterior lighting, refer to Section 417-01 .

For additional information on perimeter anti-theft, Section 419-01A .

Instrument Cluster

The instrument cluster is on the SCP communications network. It is an analog face cluster with a digital odometer. The instrument cluster displays a variety of information.

For additional information, refer to Section 413-01 .

Passenger Climate Control Seat Module

The passenger climate control seat module is on the UBP communications network. The passenger climate control seat module and DATC module control the heating and cooling elements in the seat for passenger comfort.

For additional passenger climate control seat module information, refer to Section 501-10 .

Parking Aid Module

The parking aid module is connected to the UBP communications network. The module controls sensors in the rear bumper that detect close objects when the transmission is in REVERSE.

For additional information, refer to Section 413-13 .

Powertrain Control Module (PCM)

The PCM is on the controller area network (CAN) and the SCP communications network. The PCM uses the CAN to communicate with the diagnostic tool and uses the SCP communications network to communicate with other modules. The PCM controls the engine for better fuel economy, emissions control, failure mode detection and storage.

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

Restraint Control Module (RCM)

The RCM is on the international standards organization (ISO) 9141 communications network. The RCM controls the deployment of the air bags based on sensor input.

For additional information, refer to Section 501-20B .

Navigation System Module

The navigation system module is on the SCP communications network. The navigation system module communicates with the audio unit using a dedicated CAN. The vehicle navigation system provides a feature that guides the user to any entered destination. The system uses the global positioning sensor (GPS), vehicle speed, and other sensor information to accurately establish the vehicle position. The navigation system module compares this position to the digital video disc (DVD) vector map. The system then provides the maneuvers required during the journey in order to arrive at the destination entered.

For additional information, refer to Section 415-00 .

Communications Network

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Principles of Operation

The vehicle has 4 module communications networks:

- standard corporate protocol (SCP) communications network.
- international standards organization (ISO) 9141 communications network.
- universal asynchronous receiver-transmitter (UART)-based protocol (UBP) communications network.
- high speed controller area network (CAN).

The diagnostic tool connects to all 4 communications networks through the data link connector (DLC). This makes diagnosis and testing of these systems easier by allowing one diagnostic tool to be able to diagnose and control any module on the 4 communications networks from one connector. The DLC is found under the instrument panel between the steering column and the radio.

Standard Corporate Protocol (SCP) Communications Network

The SCP communications network is an unshielded twisted pair cable, data plus circuit 4-EG7 (GY/RD) and data minus circuit 5-EG7 (BU/RD). The SCP communications network remains operational even with the severing of one of the SCP communications network circuits. Communications also continue if one of the SCP communications network circuits are shorted to ground or voltage, or if some but not all termination resistors are lost.

International Standards Organization (ISO) 9141 Communications Network

The ISO 9141 communications network uses a single circuit communications network circuit 4-EE10 (GY/BK). The ISO 9141 communications network does not permit intermodule communication. When the diagnostic tool communicates to modules on the ISO 9141 communications network, the diagnostic tool must ask for all information; the modules cannot initiate communications. The ISO 9141 communications network does not function if the circuit is shorted to ground or battery voltage. Also, if one of the modules on the ISO 9141 communications network loses power or shorts internally, communications to that module fail.

Universal Asynchronous Receiver-Transmitter (UART)-based Protocol (UBP) Communications Network

The UBP communications network uses a single circuit communications network circuit 4-ED6 (GY). The UBP communications network does not function if the circuit is shorted to ground or voltage. The UBP communications network is different from the ISO 9141 communications network in that it allows intermodule communication.

High Speed Controller Area Network (CAN)

The high speed CAN is an unshielded twisted pair cable, data plus circuit 4-EC7 (GY/RD) and data minus circuit 5-EC7 (BU/RD). The high speed CAN is not designed to operate under single point fault conditions. If either circuit is shorted to voltage or the high speed CAN data plus is shorted to ground, module-to-module and module-to-tester communication is not possible. If the high speed CAN data minus is shorted to ground or an open exists on either bus line, module-to-module and module-to-tester communication is marginal at best. The high speed CAN bus may remain operational when 1 of the 2 termination resistors are not present. If there are issues with the high speed CAN, there may be missing functionality and problems connecting with a diagnostic tool. On the high speed CAN, there are 2 terminating modules which are composed of the powertrain control module (PCM) and the instrument cluster which are located at the far opposite ends of the CAN wiring.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Central junction box (CJB) fuse 6 (10A) • Wiring harness • Loose or corroded connections

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, GO to Pinpoint Test T .

6. GO to Pinpoint Test PC .

Communications Network Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
U1262	SCP (J1850) Communication Bus Fault	Network Fault	GO to Pinpoint Test O .
U1262	SCP (J1850) Communication Bus Fault	Instrument Cluster	GO to Pinpoint Test D .
U1262	SCP (J1850) Communication Bus Fault	ABS/TC Module	GO to Pinpoint Test A .
U1262	SCP (J1850) Communication Bus Fault	Message Center	GO to Pinpoint Test O .
U1950	UBP Communication Bus Fault	Parking Aid Module	GO to Pinpoint Test S .

System Precheck

PINPOINT TEST PC: DATA LINK DIAGNOSTICS NETWORK TEST

Test Step	Result / Action to Take
PC1 RUN THE DATA LINK DIAGNOSTICS NETWORK TEST	
• Carry out the diagnostic tool data link test. • **Is system passed obtained?**	**Yes** The test passed. RETURN to the Symptom Chart of the section for the module in question. **No** If no response from the diagnostic tool, GO to Pinpoint Test T . If ISO, CAN, UBP, or SCP = SOME ECUS NO RESP/NOT EQUIP, GO to Symptom Chart . If ISO = ALL ECUS NO RESP/NOT EQUIP, GO to Pinpoint Test P . If SCP = ALL ECUS NO RESP/NOT EQUIP, GO to Pinpoint Test O . If the module in question is NO RESPONSE/NOT EQUIPPED, GO to Symptom Chart . If CAN = ALL ECUS NO RESP/NOT EQUIP, GO to Pinpoint Test H .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Anti-Lock Brake/Traction Control (ABS/TC) Module Does Not Respond To The Diagnostic Tool

Normal Operation

The ABS/TC module communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-CF6 (GY) and 5-CF6 (BU). If one of the SCP communications network circuits become shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-CF6 (GY) and 5-CF6 (BU) between the ABS/TC module C155 and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms there is an open in circuit 4-CF6 (GY) or 5-CF6 (BU), damage to the DLC C251, damage to the ABS/TC module C155, a problem in the interior auxiliary junction box (AJB) C283c, interior AJB C283d or joint connector No. 4 C223.

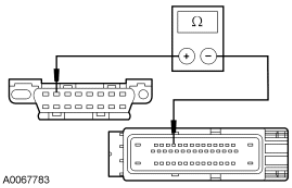
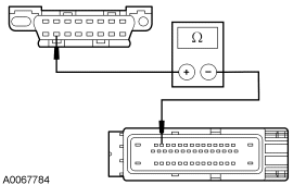
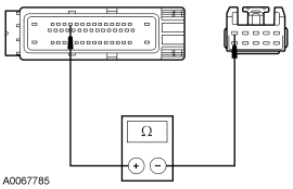
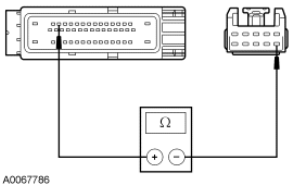
Possible Causes

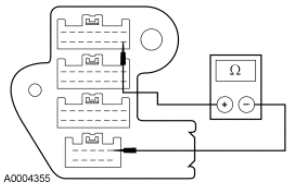
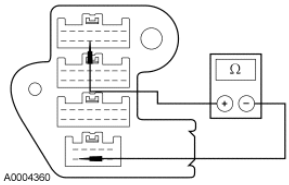
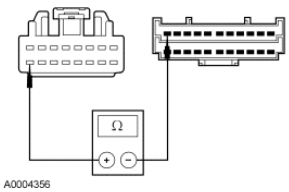
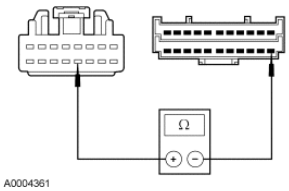
- SCP data plus circuit 4-CF6 (GY) open
- SCP data minus circuit 5-CF6 (BU) open
- joint connector No. 4 C223
- interior AJB C283c
- interior AJB C283d
- ABS/TC module C155
- ABS/TC module

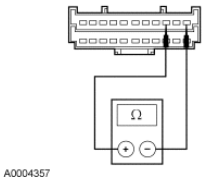
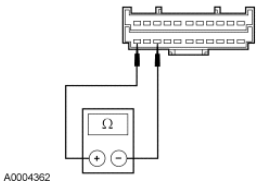
PINPOINT TEST A: THE ANTI-LOCK BRAKE/TRACTION CONTROL (ABS/TC) MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
A1 CHECK THE ABS/TC MODULE FOR DAMAGE	
• Ignition OFF. • Disconnect: ABS/TC module C155. • Inspect the ABS/TC module C155 for damage. • **Is the ABS/TC module C155 OK?**	**Yes** GO to A2 . **No** REPAIR the ABS/TC module C155 as necessary. TEST the system for normal operation.
A2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE ABS/TC MODULE C155	
• Measure the resistance between the ABS/TC module C155-12, circuit 4-CF6 (GY), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.	**Yes** GO to A7 . **No** GO to A3 .

 A0067783 • Measure the resistance between the ABS/TC module C155-14, circuit 5-CF6 (BU), harness side and the C251-10, circuit 5-EG7 (BU/RD), harness side.  A0067784 • **Are the resistances less than 5 ohms?**	
A3 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE ABS/TC MODULE C155	
• Disconnect: Interior AJB C283c. • Measure the resistance between the ABS/TC module C155-12, circuit 4-CF6 (GY), harness side and the interior AJB C283c-5, circuit 4-CF6 (GY), harness side.  A0067785 • Measure the resistance between the ABS/TC module C155-14, circuit 5-CF6 (BU), harness side and the interior AJB C283c-6, circuit 5-CF6 (BU), harness side.  A0067786 • **Are the resistances less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.
A4 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283c-5, component side.	**Yes** GO to A5 . **No** INSTALL a new interior AJB. TEST the system for normal operation.

 A0004355 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283c-6, component side.  A0004360 • **Are the resistances less than 5 ohms?**	
A5 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0004356 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  A0004361 • **Are the resistances less than 5 ohms?**	**Yes** GO to A6 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.
A6 CHECK FOR AN OPEN BETWEEN JOINT CONNECTOR NO. 4 C223	

• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4. TEST the system for normal operation.
A7 CHECK FOR CORRECT ABS/TC MODULE OPERATION	

• Disconnect all the ABS/TC module connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the ABS/TC module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ABS/TC module. REFER to Section 206-09 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Front Electronic Module (FEM) Does Not Respond To The Diagnostic Tool

Normal Operation

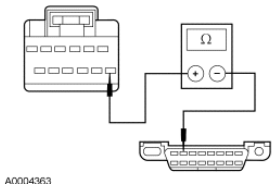
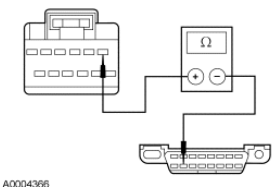
The FEM communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-EG11 (GY) and 5-EG11 (BU). If one of the SCP communications network circuits become shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-EG11 (GY) and 5-EG11 (BU) between the FEM C201c and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuits 4-EG11 (GY) and 5-EG11 (BU), damage to the DLC C251, damage to the FEM C201c, or a problem with in-line connectors, interior auxiliary junction box (AJB) C283c, interior AJB C283d or joint connector No. 4 C223.

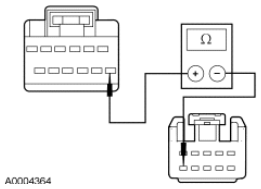
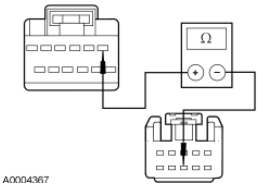
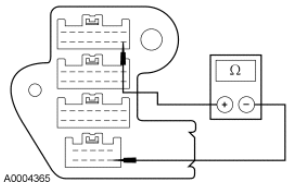
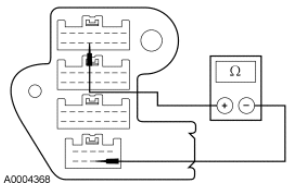
Possible Causes

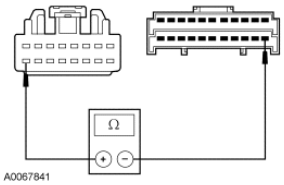
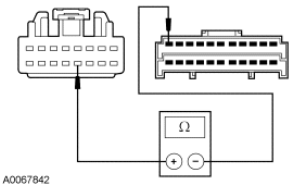
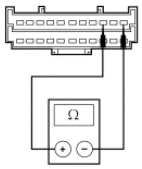
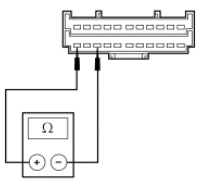
- SCP data plus circuit 4-EG11 (GY) open
- SCP data minus circuit 5-EG11 (BU) open
- joint connector No. 4 C223
- interior AJB C283c
- interior AJB C283d
- FEM C201c
- FEM

PINPOINT TEST B: THE FRONT ELECTRONIC MODULE (FEM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
B1 CHECK THE FEM C201C FOR DAMAGE	
• Ignition OFF. • Disconnect: FEM C201c. • Inspect the FEM C201c for damage. • **Is the FEM C201c OK?**	**Yes** GO to B2 . **No** Repair the FEM C201c as necessary. GO to B7 .
B2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE FEM C201C	
• Measure the resistance between the FEM C201c-7, circuit 4-EG11 (GY), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  A0004363 • Measure the resistance between the FEM C201c-1, circuit 5-EG11 (BU), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0004366 • **Are the resistances less than 5 ohms?**	**Yes** GO to B7 . **No** GO to B3 .
B3 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE FEM C201C	

• Measure the resistance between the FEM C201c-7, circuit 4-EG11 (GY), harness side and the interior AJB C283c-10, circuit 4-EG11 (GY), harness side.  A0004364 • Measure the resistance between the FEM C201c-1, circuit 5-EG11 (BU), harness side and the interior AJB C283c-8, circuit 5-EG11 (BU), harness side.  A0004367 • **Are the resistances less than 5 ohms?**	**Yes** GO to B4 . **No** REPAIR the circuit in question. TEST the system for normal operation.
B4 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283c-10, component side.  A0004365 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283c-8, component side.  A0004368 • **Are the resistances less than 5 ohms?**	**Yes** GO to B5 . **No** INSTALL a new interior AJB. TEST the system for normal operation.
B5 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	

• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0067841 • Measure the resistance between the interior C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  A0067842 • **Are the resistances less than 5 ohms?**	**Yes** GO to B6 . **No** REPAIR the circuit in question. CARRY OUT the data link diagnostics test.
B6 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC and joint connector No. 4 C223. CARRY OUT the data link diagnostics test. **No** REPAIR joint connector No. 4. TEST the system for normal operation.
B7 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	CARRY OUT the data link diagnostics test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The Restraint Control Module (RCM) Does Not Respond To The Diagnostic Tool

Normal Operation

The RCM communicates with the diagnostic tool through the international standards organization (ISO) 9141 communications network circuit 4-EE1 (GY/RD). If circuit 4-EE1 (GY/RD) becomes open or shorted to ground communications to that module are not possible. Check circuit 4-EE1 (GY/RD) between the RCM C310a and the data link connector (DLC) C251. The total resistance value must not be more than 5 ohms. If the resistance is more than 5 ohms there is an open in circuit 4-EE1 (GY/RD), damage to the DLC C251, in-line C212 or damage to the RCM C310a.

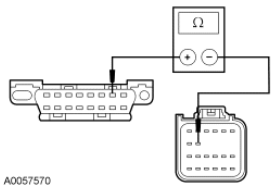
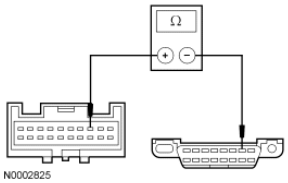
Possible Causes

- ISO 9141 circuit 4-EE1 (GY/RD) open
- in-line C212
- RCM C310a
- RCM

PINPOINT TEST C: THE RESTRAINT CONTROL MODULE (RCM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
C1 CHECK FOR AN OPEN CIRCUIT BETWEEN THE RCM C310A AND THE DLC C251	
• Ignition OFF. • Deactivate the air bag system. Refer to Section 501-20B . • Disconnect: RCM C310a. • Inspect the RCM C310a for damage. • **Is the RCM C310a OK?**	**Yes** GO to C2 . **No** REPAIR the RCM C310a as necessary. TEST the system for normal operation.
C2 CHECK FOR AN OPEN CIRCUIT BETWEEN THE RCM C310A AND THE	

DLC C251	
• Measure the resistance between the DLC C251-7, circuit 4-EE10 (GY/BK), harness side and the RCM C310a-11, circuit 4-EE10 (GY/RD), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to C4 . **No** GO to C3 .
C3 CHECK FOR AN OPEN CIRCUIT BETWEEN THE DLC C251 AND IN-LINE C212M	
• Disconnect: In-Line C212. • Measure the resistance between the DLC C251-7, circuit 4-EE10 (GY/BK), harness side and in-line C212M-8, circuit 4-EE10 (GY/BK), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit between the RCM C310a and in-line C212F. REACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation. **No** REPAIR the circuit between the DLC C251 and in-line C212M. REACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation.
C4 CHECK FOR CORRECT RCM OPERATION	

• Disconnect all the RCM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the RCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new RCM. REFER to Section 501-20B . REACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REACTIVATE the air bag system. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Instrument Cluster Does Not Respond To The Diagnostic Tool

Normal Operation

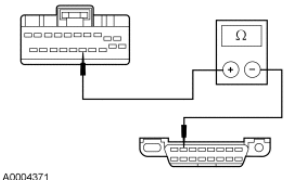
The instrument cluster communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-EG7 (GY/RD) and 5-EG7 (BU/RD). If one of the communications network circuits become shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-EG7 (GY/RD) and 5-EG7 (BU/RD) between the instrument cluster C220b and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms there is an open in circuits 4-EG7 (GY/RD) and 5-EG7 (BU/RD), damage to the DLC C251, joint connector No. 4 or damage to the instrument cluster C220b.

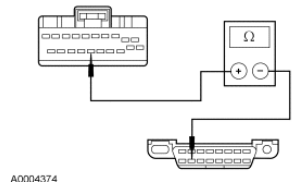
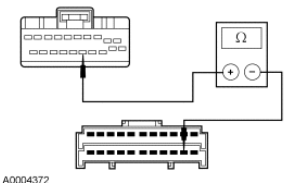
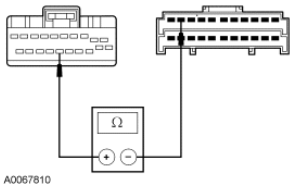
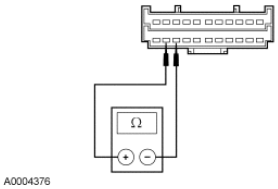
Possible Causes

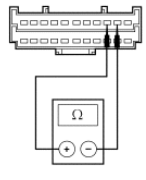
- SCP data plus circuit 4-EG7 (GY/RD) open
- SCP data minus circuit 5-EG7 (BU/RD) open
- joint connector No. 4 C223
- instrument cluster C220b
- instrument cluster

PINPOINT TEST D: THE INSTRUMENT CLUSTER DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
D1 CHECK THE INSTRUMENT CLUSTER C220B FOR DAMAGE	
• Ignition OFF. • Disconnect: Instrument Cluster C220b. • Inspect the instrument cluster C220b for damage. • **Is the instrument cluster C220b OK?**	**Yes** GO to D2 . **No** REPAIR the instrument cluster C220b as necessary. TEST the system for normal operation.
D2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE INSTRUMENT CLUSTER C220B	
• Measure the resistance between the instrument cluster C220b-15, circuit 4-EG8 (GY/VT), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  • Measure the resistance between the instrument cluster C220b-16, circuit 5-EG8 (BU/WH), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.	**Yes** GO to D5 . **No** GO to D3 .

 A0004374 • **Is the resistance less than 5 ohms?**	
D3 CHECK FOR AN OPEN BETWEEN INSTRUMENT CLUSTER C220B AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the instrument cluster C220b-15, circuit 4-EG8 (GY/VT), harness side and joint connector No. 4 C223-13, circuit 4-EG8 (GY/VT), harness side.  A0004372 • Measure the resistance between the instrument cluster C220b-16, circuit 5-EG8 (BU/WH), harness side and joint connector No. 4 C223-10, circuit 5-EG8 (BU/WH), harness side.  A0067810 • **Is the resistance less than 5 ohms?**	**Yes** GO to D4 . **No** REPAIR the circuit in question. TEST the system for normal operation.
D4 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-10, component side.  A0004376	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. TEST the system for normal operation. **No** REPAIR joint connector No. 4 as necessary. TEST the system for normal operation.

• Measure the resistance between joint connector No. 4 C223-13, component side and joint connector No. 4 C223-14, component side.  • **Are the resistances less than 5 ohms?**	
D5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	

• Disconnect all the instrument cluster connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the instrument cluster connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: No Powertrain Control Module (PCM) Standard Corporate Protocol (SCP) Communications Network Communication

Normal Operation

The PCM communicates with the modules through the standard corporate protocol (SCP) communications network. Circuits 4-RE8 (GY) and 5-RE8 (BU) receive and transmit data from the PCM to the modules. Degraded SCP communications network performance occurs if one communications network circuit is open, shorted to ground or voltage, or if one but not all termination resistors are lost.

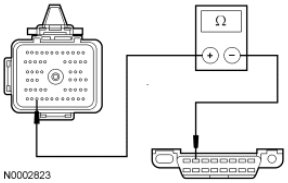
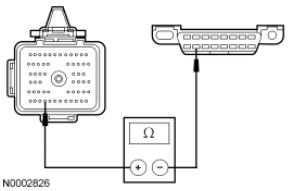
Possible Causes

- SCP data plus circuit 4-RE8 (GY) open
- SCP data minus circuit 5-RE8 (BU) open
- PCM C175b
- PCM

PINPOINT TEST E: NO POWERTRAIN CONTROL MODULE (PCM) STANDARD CORPORATE PROTOCOL (SCP) COMMUNICATIONS NETWORK COMMUNICATION

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take

E1 CHECK THE PCM C175B FOR DAMAGE	
• Ignition OFF. • Disconnect: PCM C175b. • Inspect the PCM C175b for damage. • **Is the PCM C175b OK?**	**Yes** GO to E2 . **No** REPAIR the PCM C175b as necessary. TEST the system for normal operation.
E2 CHECK FOR AN OPEN BETWEEN THE DATA LINK CONNECTOR (DLC) C251 AND THE PCM C175B	
• Measure the resistance between the PCM C175b-3, circuit 4-RE8 (GY), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  N0002823 • Measure the resistance between the PCM C175b-4, circuit 5-RE8 (BU), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  N0002826 • **Are the resistances less than 5 ohms?**	**Yes** GO to E3 . **No** REPAIR the circuit in question. TEST the system for normal operation.
E3 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	CARRY OUT the data link diagnostics test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Dual Automatic Temperature Control (DATC) Module Does Not Respond To The Diagnostic Tool

Normal Operation

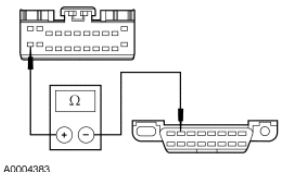
The DATC module communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuit 4-FA10 (GY/BK) and 5-FA10 (BU/YE). If one of the communications network circuits becomes shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-FA10 (GY/BK) and 5-FA10 (BU/YE) between the DATC module C228a and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms there is an open in circuits 4-FA10 (GY/BK) or 5-FA10 (BU/YE), damage to the DLC C251, the DATC module C228a, or in joint connector No. 4 C223.

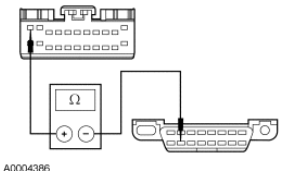
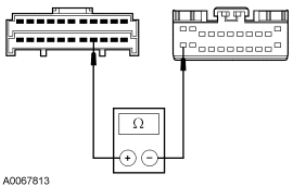
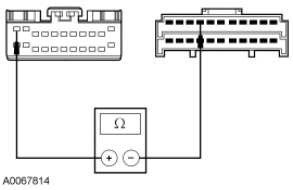
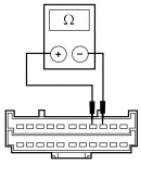
Possible Causes

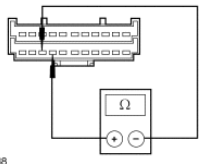
- SCP data plus circuit 4-FA10 (GY/BK) open
- SCP data minus circuit 5-FA10 (BU/YE) open
- joint connector No. 4 C223
- DATC module C228a
- DATC module

PINPOINT TEST F: THE DUAL AUTOMATIC TEMPERATURE CONTROL (DATC) MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ **CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
F1 CHECK THE DATC MODULE C228A FOR DAMAGE	
• Ignition OFF. • Disconnect: DATC Module C228a. • Inspect the DATC module C228a for damage. • **Is the DATC module C228a OK?**	**Yes** GO to F2 . **No** REPAIR the DATC module C228a as necessary. TEST the system for normal operation.
F2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE DATC MODULE C228A	
• Measure the resistance between the DATC module C228a-12, circuit 4-FA10 (GY/BK), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  A0004383 • Measure the resistance between the DATC module C228a-1, circuit 5-FA10 (BU/YE), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.	**Yes** GO to F5 . **No** GO to F3 .

 A0004386 • **Are the resistances less than 5 ohms?**	
F3 CHECK FOR AN OPEN BETWEEN THE DATC MODULE C228A AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the DATC module C228a-12, circuit 4-FA10 (GY/BK), harness side and joint connector No. 4 C223-15, circuit 4-FA10 (GY/BK), harness side.  A0067813 • Measure the resistance between the DATC module C228a-1, circuit 5-FA10 (BU/YE), harness side and joint connector No. 4 C223-8, circuit 5-FA10 (BU/YE), harness side.  A0067814 • **Are the resistances less than 5 ohms?**	**Yes** GO to F4 . **No** REPAIR the circuit in question. TEST the system for normal operation.
F4 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-14, component side and joint connector No. 4 C223-15, component side.  A0004385 • Measure the resistance between joint connector No. 4 C223-8, component side and joint connector No. 4 C223-9, component side.	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.

 A0004388 • **Are the resistances less than 5 ohms?**	
F5 CHECK FOR CORRECT DATC MODULE OPERATION	

• Disconnect all the DATC module connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the DATC module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DATC module. REFER to Section 412-01 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Audio Control Module (ACM) Does Not Respond To The Diagnostic Tool

Normal Operation

The ACM module communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-EG10 (GY/BK) and 5-EG10 (BU/YE). If one of the SCP communications network circuits becomes shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-EG10 (GY/BK) and 5-EG10 (BU/YE) between the ACM C290c and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuits 4-EG10 (GY/BK) and 5-EG10 (BU/YE), damage to the DLC C251, the ACM C290c, or joint connector No. 4 C223.

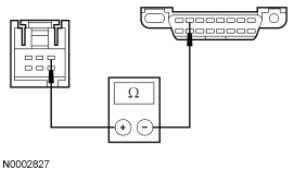
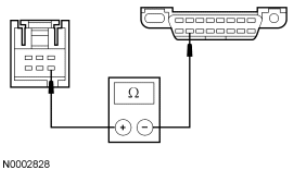
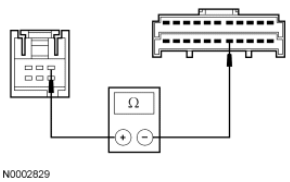
Possible Causes

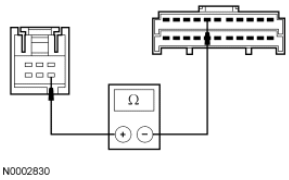
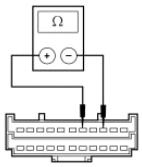
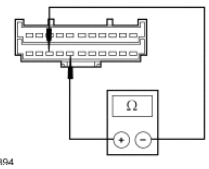
- SCP data plus circuit 4-EG10 (GY/BK) open
- SCP data minus circuit 5-EG10 (BU/YE) open
- joint connector No. 4 C223
- ACM C290c
- ACM

PINPOINT TEST G: THE AUDIO CONTROL MODULE (ACM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take

G1 CHECK THE ACM C290C FOR DAMAGE	
• Ignition OFF. • Disconnect: ACM C290c. • Inspect the ACM C290c for damage. • **Is the ACM C290c OK?**	**Yes** GO to G2 . **No** REPAIR the ACM C290c as necessary. TEST the system for normal operation.
G2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE ACM	
• Measure the resistance between the ACM C290c-1, circuit 4-EG10 (GY/BK), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  N0002827 • Measure the resistance between the ACM C290c-4, circuit 5-EG10 (BU/YE), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  N0002828 • **Are the resistances less than 5 ohms?**	**Yes** GO to G5 . **No** GO to G3 .
G3 CHECK FOR AN OPEN BETWEEN THE ACM AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the ACM C290c-1, circuit 4-EG10 (GY/BK), harness side and joint connector No. 4 C223-16, circuit 4-EG10 (GY/BK), harness side.  N0002829 • Measure the resistance between the ACM	**Yes** GO to G4 . **No** REPAIR the circuit in question. TEST the system for normal operation.

C290c-4, circuit 5-EG10 (BU/YE), harness side and joint connector No. 4 C223-7, circuit 5-EG10 (BU/YE), harness side.  N0002830 • **Are the resistances less than 5 ohms?**	
G4 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-14, component side and joint connector No. 4 C223-16, component side.  A0004391 • Measure the resistance between joint connector No. 4 C223-7, component side and joint connector No. 4 C223-9, component side.  A0004394 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
G5 CHECK FOR CORRECT ACM OPERATION	

• Disconnect all the ACM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the ACM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ACM. REFER to Section 415-00 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: The Powertrain Control Module (PCM) Does Not Respond To The Diagnostic Tool

Normal Operation

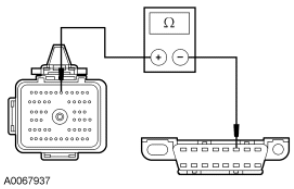
The PCM communicates with the diagnostic tool through the controller area network (CAN) circuits 4-EC7 (GY/RD) and 5-EC7 (BU/RD). If one of the CAN communications network circuits become shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-EC7 (GY/RD) and 5-EC7 (BU/RD) between the PCM C175b and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms there is an open in circuit 4-EC7 (GY/RD) or 5-EC7 (BU/RD), damage to the DLC C251, or damage to the PCM C175b.

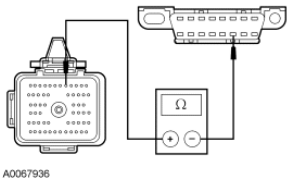
Possible Causes

- CAN data plus circuit 4-EC7 (GY/RD) open
- CAN data minus circuit 5-EC7 (BU/RD) open
- PCM C175b
- PCM

PINPOINT TEST H: THE POWERTRAIN CONTROL MODULE (PCM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
H1 CHECK THE PCM C175B FOR DAMAGE	
• Ignition OFF. • Disconnect: PCM C175b. • Inspect the PCM C175b for damage. • **Is the PCM C175b OK?**	**Yes** GO to H2 . **No** REPAIR the PCM C175b as necessary. TEST the system for normal operation.
H2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE PCM C175B	
• Measure the resistance between the PCM C175b-53, circuit 4-EC7 (GY/RD), harness side and the DLC C251-6, circuit 4-EC7 (GY/RD), harness side.  • Measure the resistance between the PCM C175b-54, circuit 5-EC7 (BU/RD), harness side and the DLC C251-14, circuit 5-EC7 (BU/RD), harness side.	**Yes** GO to H3 . **No** REPAIR the circuit in question. TEST the system for normal operation.

 A0067936 • **Are the resistances less than 5 ohms?**	
H3 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: The Driver Seat Module (DSM) Does Not Respond To The Diagnostic Tool

Normal Operation

The DSM communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-AH80 (GY/WH) and 5-AH80 (BU/OG). If circuit 4-AH80 (GY/WH) or 5-AH80 (BU/OG) becomes open or shorted to ground, communications to that module are not possible. Check circuits 4-AH80 (GY/WH) and 5-AH80 (BU/OG) between the DSM C341c and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuit 4-AH80 (GY/WH) or 5-AH80 (BU/OG), damage to the DLC C251, damage to the DSM C341c, or a problem with the interior auxiliary junction box (AJB) C283c, interior AJB C283d or joint connector No. 4 C223.

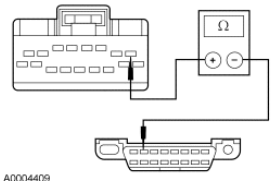
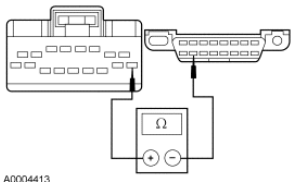
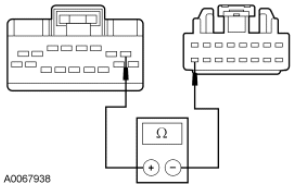
Possible Causes

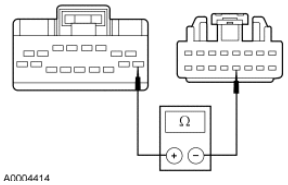
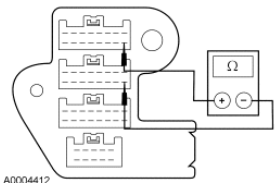
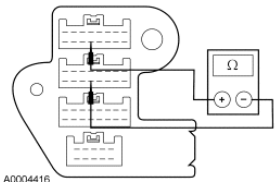
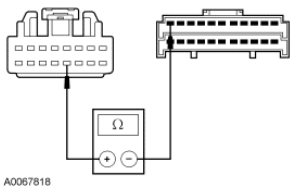
- SCP data plus circuit 4-AH80 (GY/WH) open
- SCP data minus circuit 5-AH80 (BU/OG) open
- joint connector No. 4 C223
- interior AJB C283c
- interior AJB C283d
- DSM C341c
- DSM

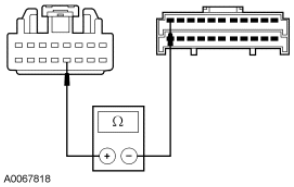
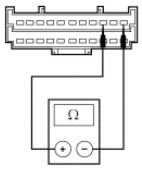
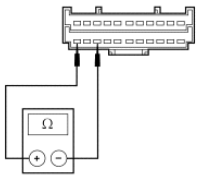
PINPOINT TEST I: THE DRIVER SEAT MODULE (DSM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
I1 CHECK THE DSM 341C FOR DAMAGE	

• Ignition OFF. • Disconnect: DSM C341c. • Inspect the DSM C341c for damage. • **Is the DSM C341c OK?**	**Yes** GO to I2 . **No** REPAIR the DSM C341c as necessary. TEST the system for normal operation.
I2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE DSM 341C	
• Measure the resistance between the DSM C341c-1, circuit 4-AH80 (GY/WH), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  A0004409 • Measure the resistance between the DSM C341c-9, circuit 5-AH80 (BU/OG), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0004413 • **Are the resistances less than 5 ohms?**	**Yes** GO to I7 . **No** GO to I3 .
I3 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283A AND THE DSM 341C	
• Disconnect: Interior AJB C283a. • Measure the resistance between the DSM C341c-1, circuit 4-AH80 (GY/WH), harness side and the interior AJB C283a-16, circuit 4-AH80 (GY/WH), harness side.  A0067938 • Measure the resistance between the DSM C341c-9, circuit 5-AH80 (BU/OG), harness side and the interior AJB C283a-12, circuit 5-AH80 (BU/OG), harness side.	**Yes** GO to I4 . **No** REPAIR the circuit in question. TEST the system for normal operation.

 A0004414 • **Are the resistances less than 5 ohms?**	
I4 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283A AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C293d. • Measure the resistance between the interior AJB C283a-16, component side and the interior AJB C283d-16, component side.  A0004417 • Measure the resistance between the interior AJB C283a-12, component side and the interior AJB C283d-12, component side.  A0004416 • **Are the resistances less than 5 ohms?**	**Yes** GO to I5 . **No** INSTALL a new interior AJB. TEST the system for normal operation.
I5 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0067818 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.	**Yes** GO to I6 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test in this section.

 A0067818 • **Are the resistances less than 5 ohms?**	
I6 CHECK FOR AN OPEN BETWEEN THE JOINT CONNECTOR NO. 4 C223 PINS	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
I7 CHECK FOR CORRECT DSM OPERATION	

• Disconnect all the DSM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the DSM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DSM. REFER to Section 419-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: The Driver Door Module (DDM) Does Not Respond To The Diagnostic Tool

Normal Operation

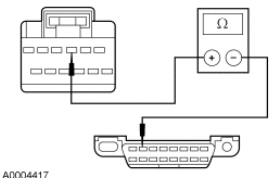
The DDM communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-EG13 (GY/OG) and 5-EG13 (GY/OG). If one of the SCP communications network circuits become shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-EG13 (GY/OG) and 5-EG13 (GY/OG) between the DDM C501a and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuit 4-EG13 (GY/OG) or 5-EG13 (GY/OG), damage to the DLC C251, damage to the DDM C155a, or a problem in the interior auxiliary junction box (AJB) C283c, interior AJB C283d or joint connector No. 4 C223.

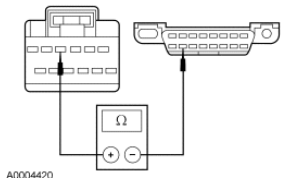
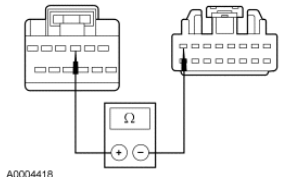
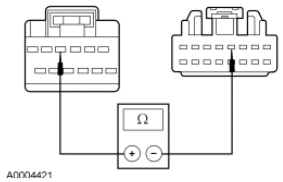
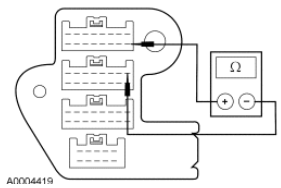
Possible Causes

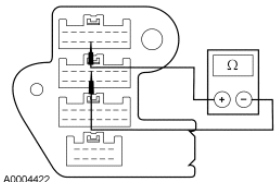
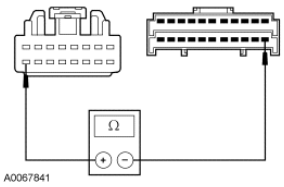
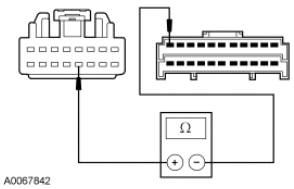
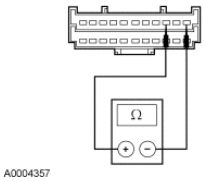
- SCP data plus circuit 4-EG13 (GY/OG) open
- SCP data minus circuit 5-EG13 (GY/OG) open
- joint connector No. 4 C223
- interior AJB C283c
- interior AJB C283d
- DDM C501a
- DDM

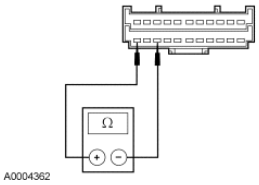
PINPOINT TEST J: THE DRIVER DOOR MODULE (DDM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
J1 CHECK THE DDM C501A FOR DAMAGE	
• Ignition OFF. • Disconnect: DDM C501a. • Inspect the DDM C501a for damage. • **Is the DDM C501a OK?**	**Yes** GO to J2 . **No** REPAIR the DDM C501a as necessary. TEST the system for normal operation.
J2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE DDM C501A	
• Measure the resistance between the DDM C501a-3, circuit 4-EG13 (GY/OG), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  A0004417 • Measure the resistance between the DDM C501a-4, circuit 5-EG13 (GY/OG), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.	**Yes** GO to J7 . **No** GO to J3 .

 • **Are the resistances less than 5 ohms?**	
J3 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283A AND THE DDM C501A	
• Disconnect: Interior AJB C283a. • Measure the resistance between the DDM C501a-3, circuit 4-EG13 (GY/OG), harness side and the interior AJB C283a-8, circuit 4-EG13 (GY/OG), harness side.  • Measure the resistance between the DDM C501a-4, circuit 5-EG13 (GY/OG), harness side and the interior AJB C283a-4, circuit 5-EG13 (GY/OG), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to J4 . **No** REPAIR the circuit in question. TEST the system for normal operation.
J4 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283A AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283a-8, component side.  • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283a-4, component side.	**Yes** GO to J5 . **No** INSTALL a new interior AJB. TEST the system for normal operation.

 • **Are the resistances less than 5 ohms?**	
J5 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to J6 . **No** REPAIR the circuit in question. TEST the system for normal operation.
J6 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.

 • **Are the resistances less than 5 ohms?**	
J7 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The Rear Electronic Module (REM) Does Not Respond To The Diagnostic Tool

Normal Operation

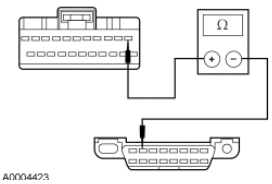
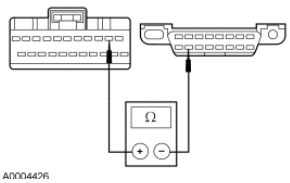
The REM communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-EG12 (GY/WH) and 5-EG12 (BU/OG). If one of the SCP communications network circuits become shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-EG12 (GY/WH) and 5-EG12 (BU/OG) between the interior auxiliary junction box (AJB) C283b, interior AJB C283d or interior AJB C223 and the data link connector (DLC) C251.

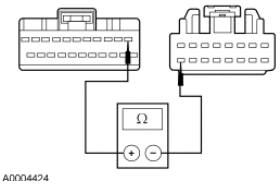
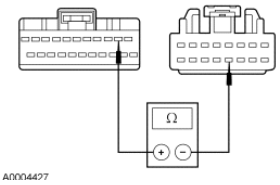
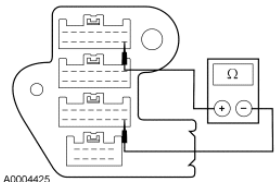
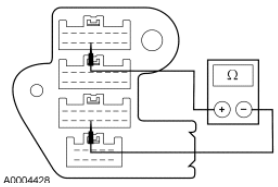
The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuits 4-EG12 (GY/WH) and 5-EG12 (BU/OG), damage to the DLC C251, damage to the REM 420b, or a problem in the interior AJB C283b, interior AJB C283d or joint connector No. 4 C223.

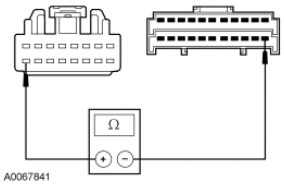
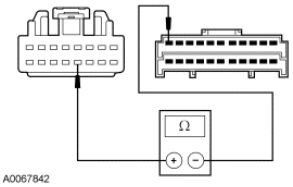
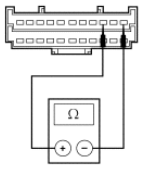
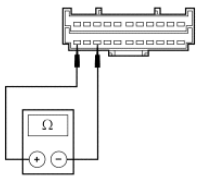
Possible Causes
- SCP data plus circuit 4-EG12 (GY/WH) open
- SCP data minus circuit 5-EG12 (BU/OG) open
- joint connector No. 4 C223
- interior AJB C283b
- interior AJB C283d
- REM C420b
- REM

PINPOINT TEST K: THE REAR ELECTRONIC MODULE (REM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
K1 CHECK THE REM C420B FOR DAMAGE	
• Ignition OFF. • Disconnect: REM C420b. • Inspect the REM C420b for damage. • **Is the REM C420b OK?**	**Yes** GO to K2 . **No** REPAIR the REM C420b as necessary. TEST the system for normal operation.
K2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE REM C420B	
• Measure the resistance between the REM C420b-1, circuit 4-EG12 (GY/WH), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  • Measure the resistance between the REM C420b-2, circuit 5-EG12 (BU/OG), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to K7 . **No** GO to K3 .
K3 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND THE REM C420B	
• Disconnect: Interior AJB C283b. • Measure the resistance between the REM C420b-1, circuit 4-EG12 (GY/WH), harness side and the interior AJB C283b-16, circuit 4-EG12 (GY/WH), harness side.	**Yes** GO to K4 . **No** REPAIR the circuit in question. TEST the system for normal operation.

 A0004424 • Measure the resistance between the REM C420b-2, circuit 5-EG12 (BU/OG), harness side and the interior AJB C283b-12, circuit 5-EG12 (BU/OG), harness side.  A0004427 • **Are the resistances less than 5 ohms?**	
K4 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283b-16, component side.  A0004425 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283b-12, component side.  A0004426 • **Are the resistances less than 5 ohms?**	**Yes** GO to K5 . **No** INSTALL a new interior AJB. TEST the system for normal operation.
K5 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.	**Yes** GO to K6 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

 A0067841 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  A0067842 • **Are the resistances less than 5 ohms?**	
K6 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
K7 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the REM connectors and make sure they seat correctly.
	Yes
	INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.

• Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test L: The Navigation System Module Does Not Respond To The Diagnostic Tool

Normal Operation

The navigation system module communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-EG17 (GY/BK) and 5-EG17 (BU/YE). If one of the SCP communications network become shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-EG17 (GY/BK) and 5-EG17 (BU/YE) between the navigation system module C4209 and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuit 4-EG17 (GY/BK) and 5-EG17 (BU/YE), damage to the DLC C251, damage to the navigation system module C4209, or a problem in the interior auxiliary junction box (AJB) C283b, interior AJB C283d, joint connector No. 4 C223 or joint connector No. 5 C427.

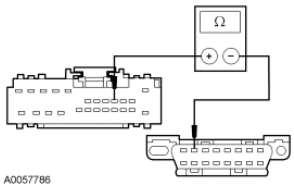
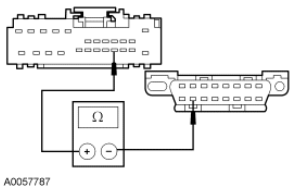
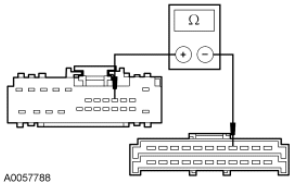
Possible Causes

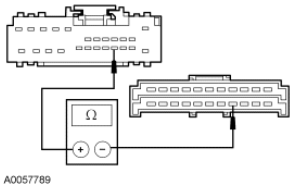
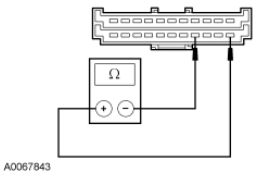
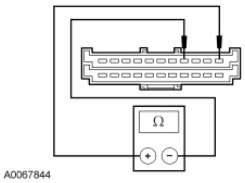
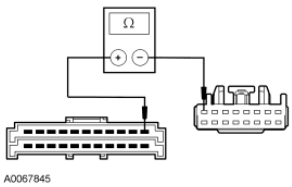
- SCP data plus circuit 4-EG17 (GY/BK) open
- SCP data minus circuit 5-EG17 (BU/YE) open
- joint connector No. 4 C223
- interior AJB C283b
- interior AJB C283d
- joint connector No. 5 C427
- navigation system module C4209
- navigation system module

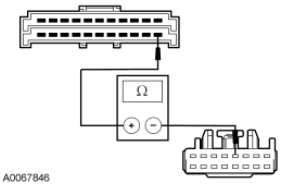
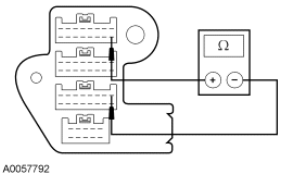
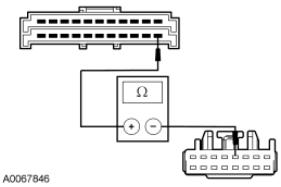
PINPOINT TEST L: THE NAVIGATION SYSTEM MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

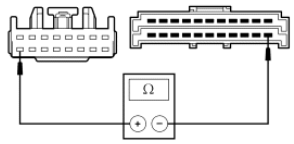
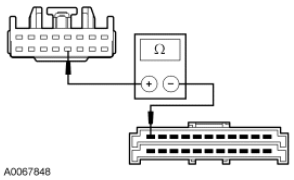
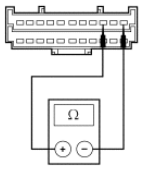
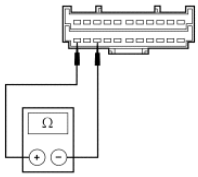
⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
L1 CHECK THE NAVIGATION SYSTEM MODULE C4209 FOR DAMAGE	
• Ignition OFF. • Disconnect: Navigation System Module C4209. • Inspect the navigation system module C4209 for damage. • **Is the navigation system module C4209 OK?**	**Yes** GO to L2 . **No** REPAIR the navigation system module C4209 as necessary. TEST the system for normal operation.
L2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE NAVIGATION SYSTEM MODULE C4209	

• Measure the resistance between the navigation system module C4209-4, circuit 4-EG17 (GY/BK), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  A0057786 • Measure the resistance between the navigation system module C4209-16, circuit 5-EG17 (BU/YE), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0057787 • **Are the resistances less than 5 ohms?**	**Yes** GO to L9 . **No** GO to L3 .
L3 CHECK FOR AN OPEN BETWEEN JOINT CONNECTOR NO. 5 C427 AND THE NAVIGATION SYSTEM MODULE C4209	
• Disconnect: Joint Connector No. 5 C427. • Measure the resistance between the navigation system module C4209-4, circuit 4-EG17 (GY/BK), harness side and joint connector No. 5 C427-4, circuit 4-EG17 (GY/BK), harness side.  A0057788 • Measure the resistance between the navigation system module C4209-16, circuit 5-EG17 (BU/YE), harness side and joint connector No. 5 C427-15, circuit 5-EG17 (BU/YE), harness side.	**Yes** GO to L4 . **No** REPAIR the circuit in question. TEST the system for normal operation.

 A0057789 • **Are the resistances less than 5 ohms?**	
L4 CHECK JOINT CONNECTOR NO. 5 C427 FOR AN OPEN	
• Measure the resistance between joint connector No. 5 C427-1, component side and joint connector No. 5 C427-4, component side.  A0067843 • Measure the resistance between joint connector No. 5 C427-12, component side and joint connector No. 5 C427-15, component side.  A0067844 • **Are the resistances less than 5 ohms?**	**Yes** GO to L5 . **No** REPAIR joint connector No. 5 C427 as necessary. TEST the system for normal operation.
L5 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND JOINT CONNECTOR NO. 5 C427	
• Disconnect: Interior AJB C283b. • Measure the resistance between the interior AJB C283b-8, circuit 4-EG1 (GY/RD), harness side and joint connector No. 5 C427-1, circuit 4-EG1 (GY/RD), harness side.  A0067845 • Measure the resistance between the interior AJB C283b-4, circuit 5-EG1 (BU/RD), harness side and joint connector No. 5 C427-12, circuit 5-EG1	**Yes** GO to L6 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

(BU/RD), harness side.  A0067846 • **Are the resistances less than 5 ohms?**	
L6 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283b-8, component side.  A0057792 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283b-4, component side.  A0067846 • **Are the resistances less than 5 ohms?**	**Yes** GO to L7 . **No** INSTALL a new interior AJB. TEST the system for normal operation.
L7 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.	**Yes** GO to L8 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

 A0067847 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  A0067848 • **Are the resistances less than 5 ohms?**	
L8 CHECK JOINT CONNECTOR NO. 4 C223 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
L9 CHECK FOR CORRECT NAVIGATION SYSTEM MODULE OPERATION	

• Disconnect all the navigation system module connectors.
• Check for:
  • corrosion
  • push-out pins
	Yes
	INSTALL a new navigation system module. REFER to Section 415-00 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.

• Connect all the navigation system module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test M: The Driver Temperature Control Seat Module Does Not Respond To The Diagnostic Tool

Normal Operation

The driver temperature control seat module communicates with the diagnostic tool through the universal asynchronous receiver-transmitter (UART)-based protocol (UBP) communications network circuit 4-HC21 (GY/OG). If circuit 4-HC21 (GY/OG) becomes open or shorted to ground, communications to that module are not possible. Check circuit 4-HC21 (GY/OG) between the temperature control seat module and the data link connector (DLC) C251. The total resistance value must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuit 4-HC21 (GY/OG), damage to the DLC C251, damage to the driver temperature control seat module C3031a, or a problem with in-line C213, in-line C315 or joint connector No. 1 C261.

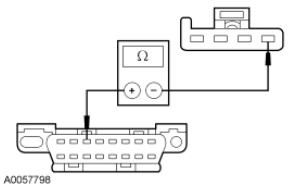
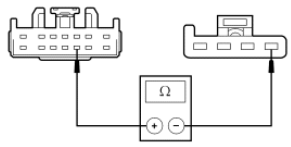
Possible Causes

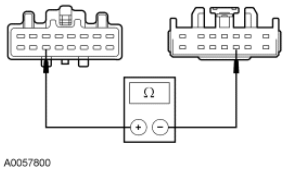
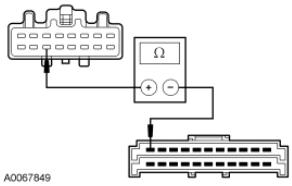
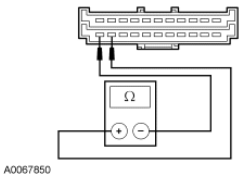
- UBP circuit 4-HC21 (GY/OG) open
- joint connector No. 1 C261
- in-line C213
- in-line C315
- driver temperature control seat module C3031a
- driver temperature control seat module

PINPOINT TEST M: THE DRIVER TEMPERATURE CONTROL SEAT MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
M1 CHECK THE DRIVER TEMPERATURE CONTROL SEAT MODULE C3031A FOR DAMAGE	
• Ignition OFF. • Disconnect: Driver Temperature Control Seat Module C3031a. • Inspect the driver temperature control seat module C3031a for damage. • **Is the driver temperature control seat module C3031a OK?**	**Yes** GO to M2 . **No** REPAIR the driver temperature control seat module C3031a. CARRY OUT the diagnostic tool data link test.
M2 CHECK CIRCUIT 4-HC21 (GY/OG) BETWEEN THE DLC C251 AND THE DRIVER TEMPERATURE CONTROL SEAT MODULE C3031A FOR AN OPEN	

• Measure the resistance between the driver temperature control seat module C3031a-1, circuit 4-HC21 (GY/OG), harness side and the DLC C251-3, circuit 4-ED6 (GY), harness side.  A0057798 • **Is the resistance less than 5 ohms?**	**Yes** GO to M9 . **No** GO to M3 .
M3 CHECK IN-LINE C315 FOR DAMAGE	
• Disconnect: In-Line C315. • Inspect in-line C315M and in-line C315F for damage. • **Are in-line C315M and in-line C315F OK?**	**Yes** GO to M4 . **No** REPAIR in-line C315M and in-line C315F. CARRY OUT the diagnostic tool data link test.
M4 CHECK CIRCUIT 4-HC21 (GY/OG) BETWEEN IN-LINE C315F AND THE DRIVER TEMPERATURE CONTROL SEAT MODULE C3031A FOR AN OPEN	
• Measure the resistance between the driver temperature control seat module C3031a-1, circuit 4-HC21 (GY/OG), harness side and in-line C315F-10, circuit 4-HC21 (GY/OG), harness side.  A0057799 • **Is the resistance less than 5 ohms?**	**Yes** GO to M5 . **No** REPAIR the circuit between in-line C315F and the driver temperature control seat module C3031a. CARRY OUT the diagnostic tool data link test.
M5 CHECK IN-LINE C213 FOR DAMAGE	
• Disconnect: In-Line C213. • Inspect in-line C213M and in-line C213F for damage. • **Are in-line C213M and in-line C213F OK?**	**Yes** GO to M6 . **No** REPAIR in-line C213M and in-line C213F. CARRY OUT the diagnostic tool data link test.
M6 CHECK CIRCUIT 4-HC21 (GY/OG) BETWEEN IN-LINE C315M AND IN-LINE C213F FOR AN OPEN	

• Measure the resistance between in-line C213F-11, circuit 4-HC1 (GY/RD), harness side and in-line C315M-10, circuit 4-HC21 (GY/OG), harness side.  A0057800 • **Is the resistance less than 5 ohms?**	**Yes** GO to M7 . **No** REPAIR the circuit between in-line C315M and in-line C213F. CARRY OUT the diagnostic tool data link test.
M7 CHECK CIRCUIT 4-HC1 (GY/RD) BETWEEN IN-LINE C213M AND JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Measure the resistance between in-line C213M-11, circuit 4-HC1 (GY/RD), harness side and joint connector No. 1 C261-11, circuit 4-HC1 (GY/RD), harness side.  A0067849 • **Is the resistance less than 5 ohms?**	**Yes** GO to M8 . **No** REPAIR the circuit between in-line C213M and joint connector No. 1 C261. CARRY OUT the diagnostic tool data link test.
M8 CHECK JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Measure the resistance between joint connector No. 1 C261-10, component side and joint connector No. 1 C261-11, component side.  A0067850 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit between joint connector No. 1 C261 and the DLC C251. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 1 C261 as necessary. CARRY OUT the diagnostic tool data link test.
M9 CHECK FOR CORRECT DRIVER TEMPERATURE CONTROL SEAT MODULE OPERATION	
• Disconnect all the driver temperature control seat module connectors. • Check for: • corrosion	**Yes** INSTALL a new driver temperature control seat module. REFER to Section 501-10 . TEST the system for normal operation.

• push-out pins • Connect all the driver temperature control seat module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	CARRY OUT the diagnostic tool data link test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: The Passenger Temperature Control Seat Module Does Not Respond To The Diagnostic Tool

Normal Operation

The passenger temperature control seat module communicates with the diagnostic tool through the universal asynchronous receiver-transmitter (UART)-based protocol (UBP) communications network circuit 4-HC22 (GY). If circuit 4-HC22 (GY) becomes open or shorted to ground, communications to that module are not possible. Check circuit 4-HC22 (GY) between the passenger temperature control seat module and the data link connector (DLC) C251. The total resistance value must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuit 4-HC22 (GY), damage to the DLC C251, damage to the passenger temperature control seat module C3036a, or a problem with in-line C213, in-line C313 or joint connector No. 1 C261.

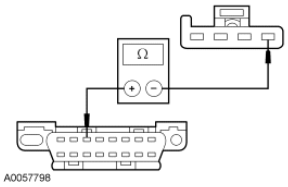
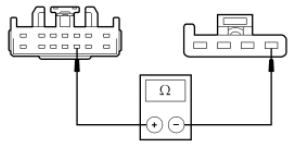
Possible Causes

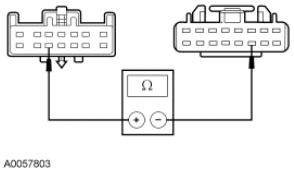
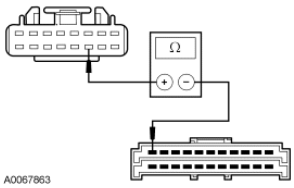
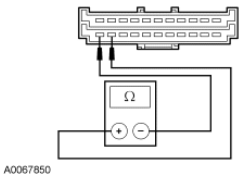
- UBP circuit 4-HC22 (GY) open
- joint connector No. 1 C261
- in-line C213
- in-line C313
- passenger temperature control seat module C3036a
- passenger temperature control seat module

PINPOINT TEST N: THE PASSENGER TEMPERATURE CONTROL SEAT MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ **CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

Test Step	Result / Action to Take
N1 CHECK THE PASSENGER TEMPERATURE CONTROL SEAT MODULE C3036A FOR DAMAGE	
• Ignition OFF. • Disconnect: Passenger Temperature Control Seat Module C3036a. • Inspect the passenger temperature control seat module C3036a for damage. • **Is the passenger temperature control seat module C3036a OK?**	**Yes** GO to N2 . **No** REPAIR the passenger temperature control seat module C3036a. CARRY OUT the diagnostic tool data link test.
N2 CHECK CIRCUIT 4-HC22 (GY) BETWEEN THE DLC C251 AND THE PASSENGER TEMPERATURE CONTROL SEAT MODULE	

C3036A FOR AN OPEN	
• Measure the resistance between the passenger temperature control seat module C3036a-1, circuit 4-HC22 (GY), harness side and the DLC C251-3, circuit 4-ED6 (GY), harness side.  A0057798 • **Is the resistance less than 5 ohms?**	**Yes** GO to N9 . **No** GO to N3 .
N3 CHECK IN-LINE C313 FOR DAMAGE	
• Disconnect: In-Line C313. • Inspect in-line C313M and in-line C313F for damage. • **Are in-line C313M and in-line C313F OK?**	**Yes** GO to N4 . **No** REPAIR in-line C313M and in-line C313F. CARRY OUT the diagnostic tool data link test.
N4 CHECK CIRCUIT 4-HC22 (GY) BETWEEN IN-LINE C313F AND THE PASSENGER TEMPERATURE CONTROL SEAT MODULE C3036A FOR AN OPEN	
• Measure the resistance between the passenger temperature control seat module C3036a-1, circuit 4-HC22 (GY), harness side and in-line C313F-10, circuit 4-HC22 (GY), harness side.  A0057799 • **Is the resistance less than 5 ohms?**	**Yes** GO to N5 . **No** REPAIR the circuit between in-line C313F and the passenger temperature control seat module C3036a. CARRY OUT the diagnostic tool data link test.
N5 CHECK IN-LINE C213 FOR DAMAGE	
• Disconnect: In-Line C213. • Inspect in-line C213M and in-line C213F for damage. • **Are in-line C213M and in-line C213F OK?**	**Yes** GO to N6 . **No** REPAIR in-line C213M and in-line C213F. CARRY OUT the diagnostic tool data link test.
N6 CHECK CIRCUIT 4-HC22 (GY) BETWEEN IN-LINE C313M AND IN-LINE C213F FOR AN OPEN	

• Measure the resistance between in-line C213F-11, circuit 4-HC1 (GY/RD), harness side and in-line C313M-10, circuit 4-HC22 (GY), harness side.  A0057803 • **Is the resistance less than 5 ohms?**	**Yes** GO to N7 . **No** REPAIR the circuit between in-line C313M and in-line C213F. CARRY OUT the diagnostic tool data link test.
N7 CHECK CIRCUIT 4-HC1 (GY/RD) BETWEEN IN-LINE C213F AND JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Measure the resistance between in-line C213F-11, circuit 4-HC1 (GY/RD), harness side and joint connector No. 1 C261-11, circuit 4-HC1 (GY/RD), harness side.  A0067863 • **Is the resistance less than 5 ohms?**	**Yes** GO to N8 . **No** REPAIR the circuit between in-line C213F and joint connector No. 1 C261. CARRY OUT the diagnostic tool data link test.
N8 CHECK FOR AN OPEN AT JOINT CONNECTOR NO. 1 C261	
• Measure the resistance between joint connector No. 1 C261-10, component side and joint connector No. 1 C261-11, component side.  A0067850 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit between joint connector No. 1 C261 and the DLC C251. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 1 C261 as necessary. CARRY OUT the diagnostic tool data link test.
N9 CHECK FOR CORRECT PASSENGER TEMPERATURE CONTROL SEAT MODULE OPERATION	
• Disconnect all the passenger temperature control seat module connectors. • Check for: • corrosion	**Yes** INSTALL a new passenger temperature control seat module. REFER to Section 501-10 . TEST the system for normal operation.

• push-out pins • Connect all the passenger temperature control seat module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	CARRY OUT the diagnostic tool data link test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test O: No Standard Corporate Protocol (SCP) Communications Network Communication

Normal Operation

The anti-lock brake system/traction control (ABS/TC) module, dual automatic temperature control (DATC) module, audio control module (ACM), rear electronic module (REM), front electronic module (FEM), electronic parking brake module, driver seat module (DSM), driver door module (DDM), navigation system module, and the instrument cluster communicate with the diagnostic tool through the SCP communications network circuits.

The powertrain control module (PCM) communicates with all modules on the SCP communications network. If one of the SCP communications network circuits becomes shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. If a module is lost due to internal concerns, communications can continue to all other modules. Check the SCP communications network circuits between the PCM C175b, ACM C290c, ABS/TC module C155, DATC module C228a, instrument cluster C220b, navigation system module C4209, electronic parking brake module C4205b, DDM C501a, DSM C341c, FEM C201c, REM C420b, and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms. If the resistance is more than 5 ohms there is an open in one or both SCP communications network circuits, damage to the PCM C175b, ACM C290c, ABS/TC module C155, DATC module C228a, instrument cluster C220b, navigation system module C4209, electronic parking brake module C4205b, DDM C501a, DSM C341c, FEM C201c, REM C420b, in-line C315, interior auxiliary junction box (AJB) C283a, interior AJB C283b, interior AJB C283c, interior AJB C283d, joint connector No. 4 C223, joint connector No. 5 C427 and the DLC C251.

If, after individual checks of each circuit leading to a module show resistance values less than 5 ohms and no in-line connector issues present, the diagnostic tool data link test must be run with the module in question disconnected. If the data link diagnostic test passes with the module in question disconnected, the module is the source of the concern and should be removed and a new module installed.

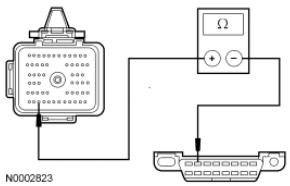
Possible Causes

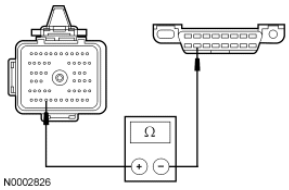
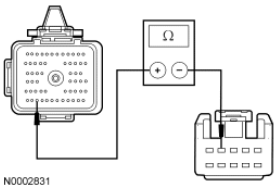
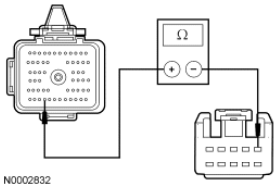
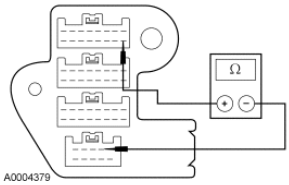
- SCP communications network circuits open, short to ground, or short to voltage
- DLC C251
- interior AJB C283a
- interior AJB C283b
- interior AJB C283c
- interior AJB C283d
- joint connector No. 4 C223
- joint connector No. 5 C427
- in-line C315
- ABS/TC module
- PCM
- DATC module
- ACM

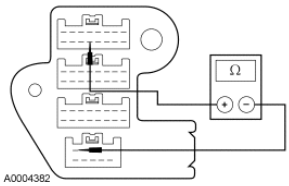
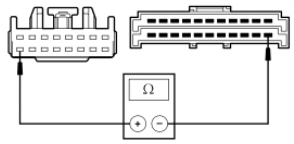
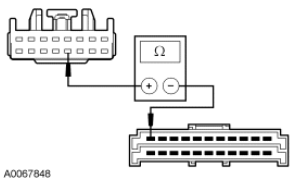
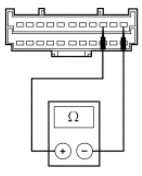
- FEM
- REM
- DSM
- DDM
- instrument cluster
- navigation system module
- electronic parking brake module

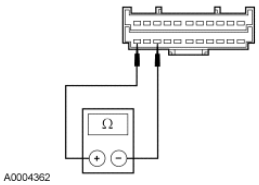
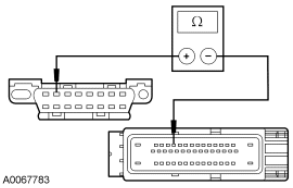
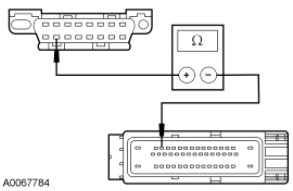
PINPOINT TEST O: NO STANDARD CORPORATE PROTOCOL (SCP) COMMUNICATIONS NETWORK COMMUNICATION

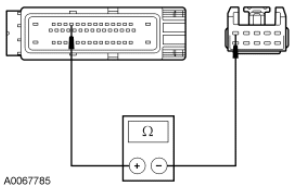
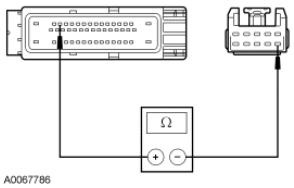
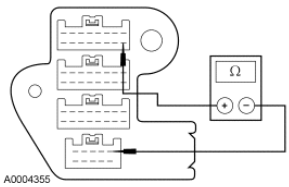
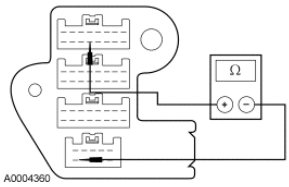
⚠ **CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.**

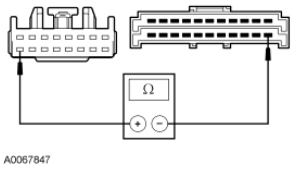
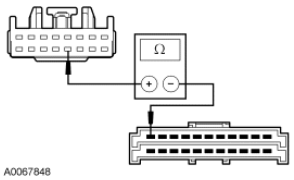
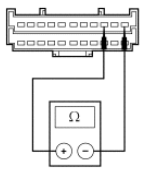
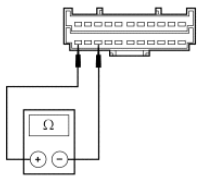
Test Step	Result / Action to Take
O1 CHECK THE DLC C251 FOR DAMAGE	
• Ignition OFF. • Inspect the DLC C251 for damage. • **Is the DLC C251 OK?**	**Yes** GO to O2 . **No** REPAIR the DLC C251. CARRY OUT the diagnostic tool data link test.
O2 CHECK THE PCM C175B FOR DAMAGE	
• Disconnect: PCM C175b. • Inspect the PCM C175b for damage. • **Is the PCM C175b OK?**	**Yes** GO to O3 . **No** REPAIR the PCM C175b as necessary. TEST the system for normal operation.
O3 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE PCM C175B	
• Measure the resistance between the PCM C175b-3, circuit 4-RE8 (GY), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  • Measure the resistance between the PCM C175b-4, circuit 5-RE8 (BU), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.	**Yes** GO to O8 . **No** GO to O4 .

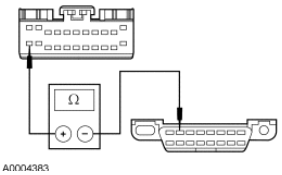
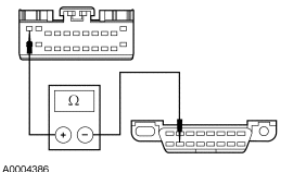
 N0002826 • **Are the resistances less than 5 ohms?**	
O4 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE PCM C175B	
• Disconnect: Interior AJB C283c. • Measure the resistance between the PCM C175b-3, circuit 4-RE8 (GY), harness side and the interior AJB C283c-4, circuit 4-RE8 (GY), harness side.  N0002831 • Measure the resistance between the PCM C175b-4, circuit 5-RE8 (BU), harness side and the interior AJB C283c-1, circuit 5-RE8 (BU), harness side.  N0002832 • **Are the resistances less than 5 ohms?**	**Yes** GO to O5 . **No** REPAIR the circuit in question. TEST the system for normal operation.
O5 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283c-4, component side.  A0004379 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283c-1, component side.	**Yes** GO to O6 . **No** INSTALL a new interior AJB. TEST the system for normal operation.

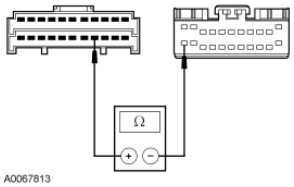
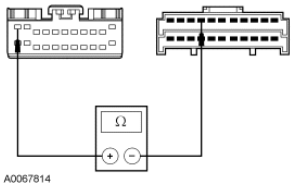
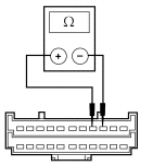
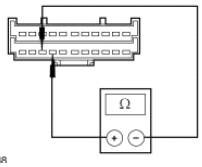
 A0004382 • **Are the resistances less than 5 ohms?**	
O6 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0067847 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  A0067848 • **Are the resistances less than 5 ohms?**	**Yes** GO to O7 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.
O7 CHECK FOR AN OPEN AT JOINT CONNECTOR NO. 4 C223	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.

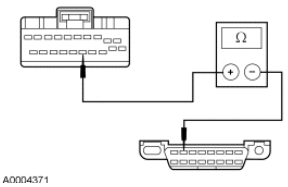
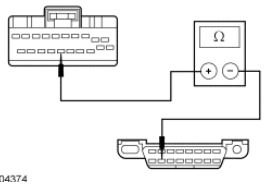
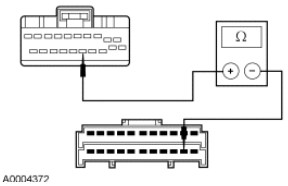
C223-11, component side.  • **Are the resistances less than 5 ohms?**	
O8 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE PCM C175B DISCONNECTED	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O77 . **No** GO to O9 .
O9 CHECK THE ABS/TC MODULE FOR DAMAGE	
• Ignition OFF. • Connect: PCM C175b. • Connect: Interior AJB C283c. • Connect: Interior AJB C283d. • Connect: Joint Connector No. 4 C223. • Disconnect: ABS/TC module C155. • Inspect the ABS/TC module C155 for damage. • **Is the ABS/TC module C155 OK?**	**Yes** GO to O10 . **No** REPAIR the ABS/TC module C155 as necessary. TEST the system for normal operation.
O10 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE ABS/TC MODULE C155	
• Measure the resistance between the ABS/TC module C155-12, circuit 4-CF6 (GY), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  • Measure the resistance between the ABS/TC module C155-14, circuit 5-CF6 (BU), harness side and the C251-10, circuit 5-EG7 (BU/RD), harness side.  	**Yes** GO to O15 . **No** GO to O11 .

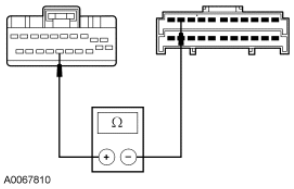
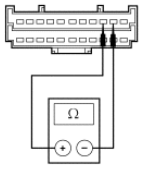
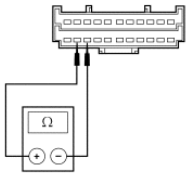
• **Are the resistances less than 5 ohms?**	
O11 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE ABS/TC MODULE C155	
• Disconnect: Interior AJB C283c. • Measure the resistance between the ABS/TC module C155-12, circuit 4-CF6 (GY), harness side and the interior AJB C283c-5, circuit 4-CF6 (GY), harness side.  • Measure the resistance between the ABS/TC module C155-14, circuit 5-CF6 (BU), harness side and the interior AJB C283c-6, circuit 5-CF6 (BU), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to O12 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.
O12 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, and the interior AJB C283c-5, component side.  • Measure the resistance between the interior AJB C283d-12, and the interior AJB 283c-6, component side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to O13 . **No** INSTALL a new interior AJB. TEST the system for normal operation.

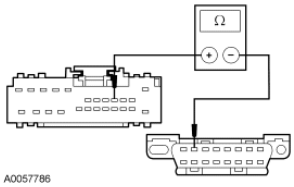
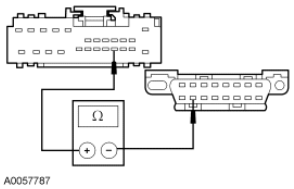
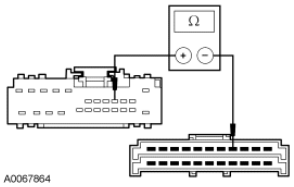
O13 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0067847 • Measure the resistance between the interior C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-22, circuit 5-EG1 (BU/RD), harness side.  A0067848 • **Are the resistances less than 5 ohms?**	**Yes** GO to O14 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.
O14 CHECK JOINT CONNECTOR NO. 4 C223 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.

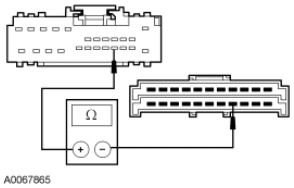
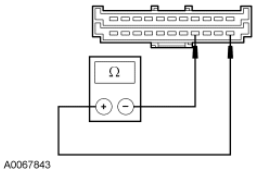
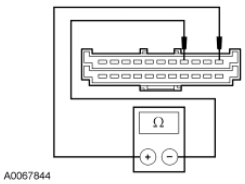
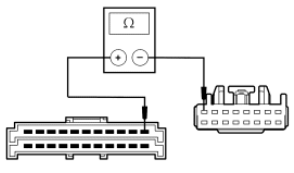
• **Are the resistances less than 5 ohms?**	
O15 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE ABS/TC MODULE C155 DISCONNECTED	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O78 . **No** GO to O16 .
O16 CHECK THE DATC MODULE C228A FOR DAMAGE	
• Ignition OFF. • Connect: ABS/TC Module C155. • Connect: Interior AJB C283c. • Connect: Interior AJB C283d. • Connect: Joint Connector No. 4 C223. • Disconnect: DATC Module C228a. • Inspect the DATC module C228a for damage. • **Is the DATC module C228a OK?**	**Yes** GO to O17 . **No** REPAIR the DATC module C228a as necessary. TEST the system for normal operation.
O17 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE DATC MODULE C228A	
• Measure the resistance between the DATC module C228a-12, circuit 4-FA10 (GY/BK), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  A0004383 • Measure the resistance between the DATC module C228a-1, circuit 5-FA10 (BU/YE), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0004386 • **Are the resistances less than 5 ohms?**	**Yes** GO to O20 . **No** GO to O18 .
O18 CHECK FOR AN OPEN BETWEEN THE DATC MODULE C228A AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the DATC module C228a-12, circuit 4-FA10 (GY/BK), harness side and joint connector No. 4 C223-15, circuit 4-FA10 (GY/BK), harness side.	**Yes** GO to O19 . **No** REPAIR the circuit in question. TEST the system for normal

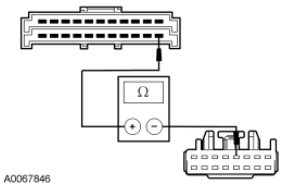
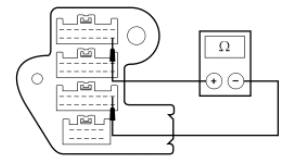
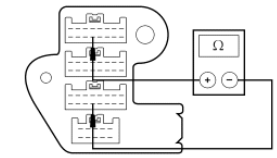
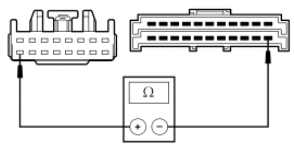
 A0067813 • Measure the resistance between the DATC module C228a-1, circuit 5-FA10 (BU/YE), harness side and joint connector No. 4 C223-8, circuit 5-FA10 (BU/YE), harness side.  A0067814 • **Are the resistances less than 5 ohms?**	operation.
O19 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN (COMPONENT SIDE)	
• Measure the resistance between joint connector No. 4 C223-14, component side and joint connector No. 4 223-15, component side.  A0004385 • Measure the resistance between joint connector No. 4 C223-8, component side and joint connector No. 4 C223-9, component side.  A0004388 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
O20 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE DATC MODULE C228A DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O79 . **No** GO to O21 .

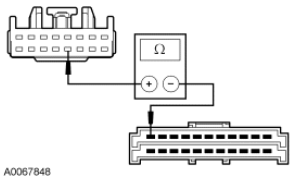
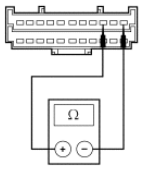
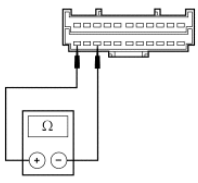
O21 CHECK THE INSTRUMENT CLUSTER C220B FOR DAMAGE	
• Ignition OFF. • Connect: DATC Module C228a. • Connect: Joint Connector No. 4 C223. • Disconnect: Instrument Cluster C220b. • Inspect the instrument cluster C220b for damage. • **Is the instrument cluster C220b OK?**	**Yes** GO to O22 . **No** REPAIR the instrument cluster C220b as necessary. TEST the system for normal operation.
O22 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE INSTRUMENT CLUSTER C220B	
• Measure the resistance between the instrument cluster C220b-15, circuit 4-EG8 (GY/VT), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  A0004371 • Measure the resistance between the instrument cluster C220b-16, circuit 5-EG8 (BU/WH), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0004374 • **Is the resistance less than 5 ohms?**	**Yes** GO to O25 . **No** GO to O23 .
O23 CHECK FOR AN OPEN BETWEEN THE INSTRUMENT CLUSTER C220B AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the instrument cluster C220b-15, circuit 4-EG8 (GY/VT), harness side and joint connector No. 4 C223-13, circuit 4-EG8 (GY/VT), harness side.  A0004372	**Yes** GO to O24 . **No** REPAIR the circuit in question. TEST the system for normal operation.

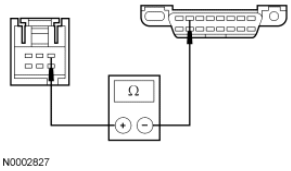
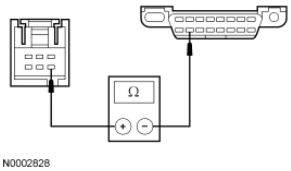
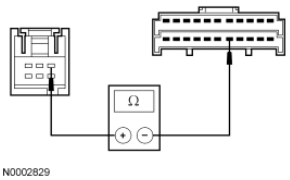
• Measure the resistance between the instrument cluster C220b-16, circuit 5-EG8 (BU/WH), harness side and joint connector No. 4 C223-10, circuit 5-EG8 (BU/WH), harness side.  A0067810 • **Is the resistance less than 5 ohms?**	
O24 CHECK FOR AN OPEN AT JOINT CONNECTOR NO. 4 (COMPONENT SIDE)	
• Measure the resistance between joint connector No. 4 C223-13, component side and joint connector No. 4 C223-14, component side.  A0004373 • Measure the resistance between joint connector No. 4 C223-10, component side and joint connector No. 4 C223-9, component side.  A0004376 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. TEST the system for normal operation. **No** REPAIR joint connector No. 4 C223 as necessary. TEST the system for normal operation.
O25 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE INSTRUMENT CLUSTER C220B DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O80 . **No** GO to O26 .
O26 CHECK THE NAVIGATION SYSTEM MODULE C4209 FOR DAMAGE	
• Ignition OFF. • Connect: Instrument Cluster C220b.	**Yes** GO to O27 .

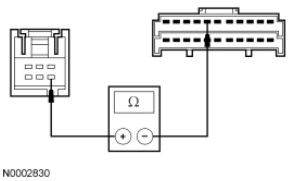
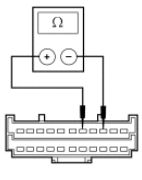
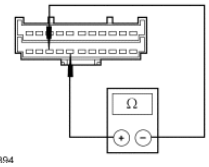
• Connect: Joint Connector No. 4 C223. • Disconnect: Navigation System Module C4209. • Inspect the navigation system module C4209 for damage. • **Is the navigation system module C4209 OK?**	**No** REPAIR the navigation system module C4209 as necessary. TEST the system for normal operation.
O27 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE NAVIGATION SYSTEM MODULE C4209	
• Measure the resistance between the navigation system module C4209-4, circuit 4-EG17 (GY/BK), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  A0057786 • Measure the resistance between the navigation system module C4209-16, circuit 5-EG17 (BU/YE), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0057787 • **Are the resistances less than 5 ohms?**	**Yes** GO to O34 . **No** GO to O28 .
O28 CHECK FOR AN OPEN BETWEEN JOINT CONNECTOR NO. 5 C427 AND THE NAVIGATION SYSTEM MODULE C4209	
• Disconnect: Joint Connector No. 5 C427. • Measure the resistance between the navigation system module C4209-4, circuit 4-EG17 (GY/BK), harness side and joint connector No. 5 C427-4, circuit 4-EG17 (GY/BK), harness side.  A0067864 • Measure the resistance between the navigation system module C4209-16, circuit 5-EG17 (BU/YE), harness side and joint connector No. 5 C427-15, circuit 5-EG17 (BU/YE), harness side.	**Yes** GO to O29 . **No** REPAIR the circuit in question. TEST the system for normal operation.

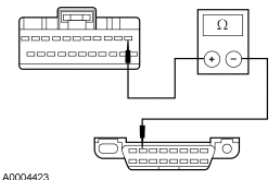
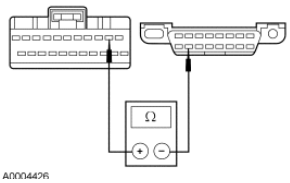
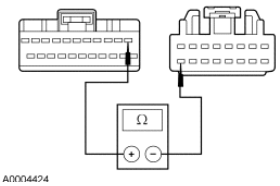
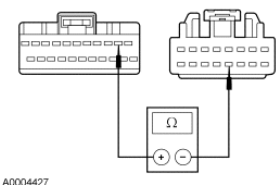
 A0067865 • **Are the resistances less than 5 ohms?**	
O29 CHECK JOINT CONNECTOR NO. 5 C427 FOR AN OPEN	
• Measure the resistance between joint connector No. 5 C427-1, component side and joint connector No. 5 C427-4, component side.  A0067843 • Measure the resistance between joint connector No. 5 C427-12, component side and joint connector No. 5 C427-15, component side.  A0067844 • **Are the resistances less than 5 ohms?**	**Yes** GO to O30 . **No** REPAIR joint connector No. 5 C427 as necessary. TEST the system for normal operation.
O30 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND JOINT CONNECTOR NO. 5 C427	
• Disconnect: Interior AJB C283b. • Measure the resistance between the interior AJB C283b-8, circuit 4-EG1 (GY/RD), harness side and joint connector No. 5 C427-1, circuit 4-EG1 (GY/RD), harness side.  A0067845 • Measure the resistance between the interior AJB C283b-4, circuit 5-EG1 (BU/RD), harness side and joint connector No. 5 C427-12, circuit 5-EG1 (BU/RD), harness side.	**Yes** GO to O31 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

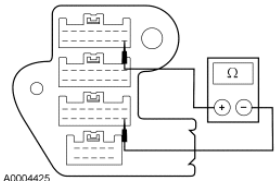
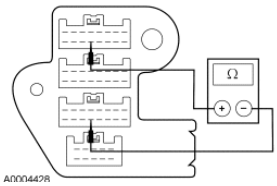
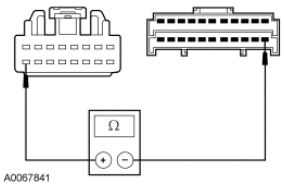
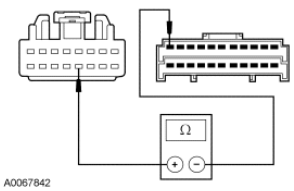
 A0067846 • **Are the resistances less than 5 ohms?**	
O31 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283b-8, component side.  A0057792 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283b-4, component side.  A0057793 • **Are the resistances less than 5 ohms?**	**Yes** GO to O32 . **No** INSTALL a new interior AJB. TEST the system for normal operation.
O32 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0067847 • Measure the resistance between the interior AJB	**Yes** GO to O33 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

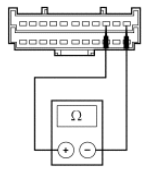
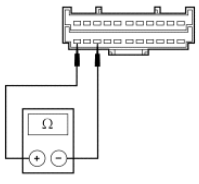
C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  A0067848 • **Are the resistances less than 5 ohms?**	
O33 CHECK JOINT CONNECTOR NO. 4 C223 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
O34 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE NAVIGATION SYSTEM MODULE C4209 DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O81 . **No** GO to O35 .
O35 CHECK THE ACM C290C FOR DAMAGE	
• Ignition OFF. • Connect: Navigation System Module C4209. • Connect: Interior AJB C283b. • Connect: Interior AJB C283d.	**Yes** GO to O36 . **No** REPAIR the ACM C290c as

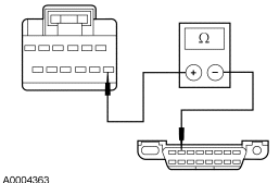
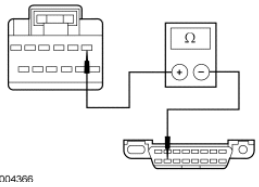
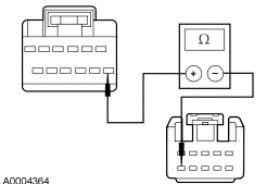
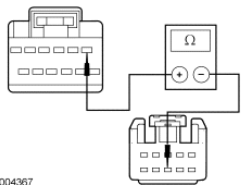
• Connect: Joint Connector No. 5 C427. • Connect: Joint Connector No. 4 C223. • Disconnect: ACM C290c. • Inspect ACM C290c for damage. • **Is the ACM C290c OK?**	necessary. TEST the system for normal operation.
O36 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE ACM C290C	
• Measure the resistance between the ACM C290c-1, circuit 4-EG10 (GY/BK), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  N0002827 • Measure the resistance between the ACM C290c-4, circuit 5-EG10 (BU/YE), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  N0002828 • **Are the resistances less than 5 ohms?**	**Yes** GO to O39 . **No** GO to O37 .
O37 CHECK FOR AN OPEN BETWEEN THE ACM AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the ACM C290c-1 circuit 4-EG10 (GY/BK), harness side and joint connector No. 4 C223-16, circuit 4-EG10 (GY/BK), harness side.  N0002829 • Measure the resistance between the ACM C290c-4 circuit 5-EG10 (BU/YE), harness side and joint connector No. 4 C223-7, circuit 5-EG10 (BU/YE), harness side.	**Yes** GO to O38 . **No** REPAIR the circuit in question. TEST the system for normal operation.

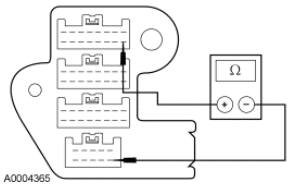
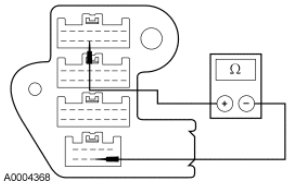
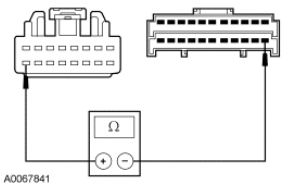
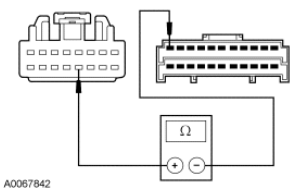
 N0002830 • **Are the resistances less than 5 ohms?**	
O38 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-16, component side and joint connector No. 4 C223-14, component side.  A0004391 • Measure the resistance between joint connector No. 4 C223-7, component side and joint connector No. 4 C223-9, component side.  A0004394 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
O39 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE ACM C290C DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O82 . **No** GO to O40 .
O40 CHECK THE REM C420B FOR DAMAGE	
• Ignition OFF. • Connect: ACM C290c. • Connect: Joint Connector No. 4 C223. • Disconnect: REM C420b. • Inspect the REM C420b for damage. • **Is the REM C420b OK?**	**Yes** GO to O41 . **No** REPAIR the REM C420b as necessary. TEST the system for normal operation.
O41 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE REM C420B	

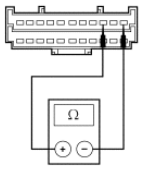
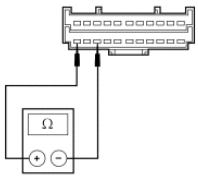
• Measure the resistance between the REM C420b-1, circuit 4-EG12 (GY/WH), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.  • Measure the resistance between the REM C420b-2, circuit 5-EG12 (BU/OG), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to O46 . **No** GO to O42 .
O42 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND THE REM C420B	
• Disconnect: Interior AJB C283b. • Measure the resistance between the REM C420b-1, circuit 4-EG12 (GY/WH), harness side and the interior AJB C283b-16, circuit 4-EG11 (GY), harness side.  • Measure the resistance between the REM C420b-2, circuit 5-EG12 (BU/OG), harness side and the interior AJB C283b-12, circuit 5-EG11 (BU), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to O43 . **No** REPAIR the circuit in question. TEST the system for normal operation.
O43 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND THE INTERIOR AJB C283D	

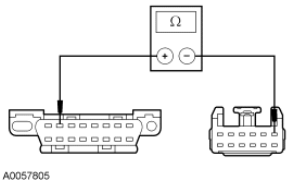
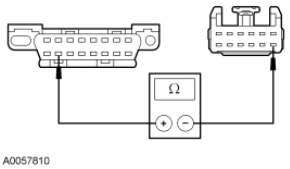
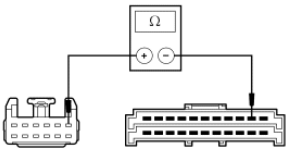
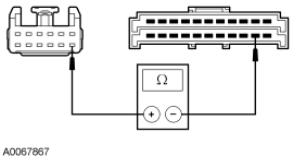
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283b-16, component side.  • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283b-12, component side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to O44 . **No** INSTALL a new interior AJB. TEST the system for normal operation.
O44 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between interior the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to O45 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

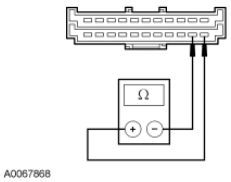
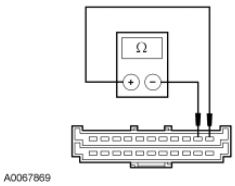
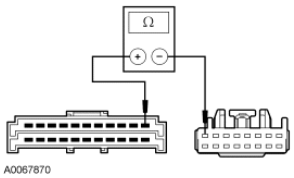
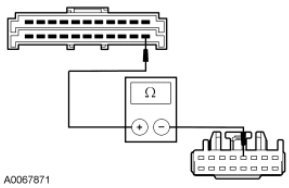
O45 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
O46 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE REM C420B DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O83 . **No** GO to O47 .
O47 CHECK THE FEM C201C FOR DAMAGE	
• Ignition OFF. • Connect: REM C420b. • Connect: Interior AJB C283b. • Connect: Interior AJB C283d. • Connect: Joint Connector No. 4 C223. • Disconnect: FEM C201c. • Inspect the FEM C201c for damage. • **Is the FEM C201c OK?**	**Yes** GO to O48 . **No** REPAIR the FEM C201c as necessary. TEST the system for normal operation.
O48 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE FEM C201C	
• Measure the resistance between the FEM C201c-7, circuit 4-EG11 (GY), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.	**Yes** GO to O53 . **No** GO to O49 .

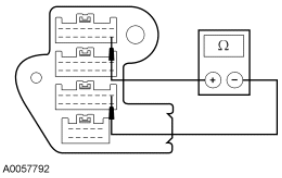
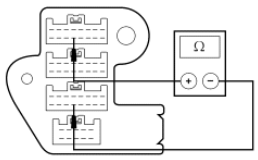
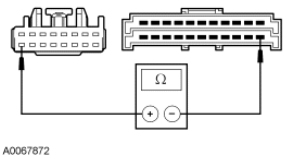
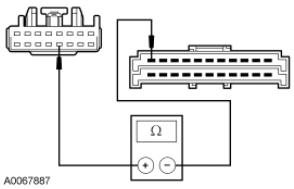
 A0004363 • Measure the resistance between the FEM C201c-1, circuit 5-EG11 (BU), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0004366 • **Are the resistances less than 5 ohms?**	
O49 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE FEM C201C	
• Disconnect: Interior AJB C283c. • Measure the resistance between the FEM C201c-7, circuit 4-EG11 (GY), harness side and the interior AJB C283c-10, circuit 4-EG11 (GY), harness side.  A0004364 • Measure the resistance between the FEM C201c-1, circuit 5-EG11 (BU), harness side and the interior AJB C283c-8, circuit 5-EG11 (BU), harness side.  A0004367 • **Are the resistance less than 5 ohms?**	**Yes** GO to O50 . **No** REPAIR the circuit in question. TEST the system for normal operation.
O50 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283C AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283c-10, component side.	**Yes** GO to O51 . **No** INSTALL a new interior AJB. TEST the system for normal operation.

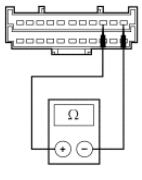
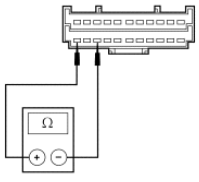
 A0004365 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283c-8, component side.  A0004368 • **Are the resistances less than 5 ohms?**	
O51 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-11, circuit 4-EG1 (GY/RD), harness side.  A0067841 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-12, circuit 5-EG1 (BU/RD), harness side.  A0067842 • **Are the resistances less than 5 ohms?**	**Yes** GO to O52 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.
O52 CHECK JOINT CONNECTOR NO. 4 FOR AN OPEN	

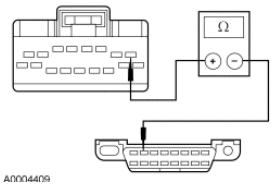
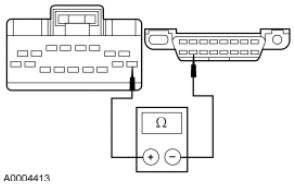
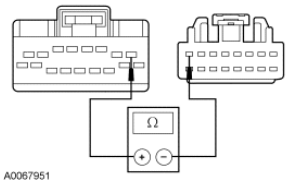
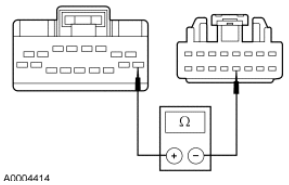
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-11, component side and joint connector No. 4 C223-9, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
O53 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE FEM C201C DISCONNECTED	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O84 . **No** GO to O54 .
O54 CHECK THE ELECTRONIC PARKING BRAKE MODULE C4205B FOR DAMAGE	
• Ignition OFF. • Connect: FEM C201c. • Connect: Interior AJB C283c. • Connect: Interior AJB C283d. • Connect: Joint Connector No. 4 C223. • Disconnect: Electronic Parking Brake Module C4205b. • Inspect the electronic parking brake module C4205b for damage. • **Is the electronic parking brake module C4205b OK?**	**Yes** GO to O55 . **No** REPAIR the electronic parking brake module C4205b as necessary. TEST the system for normal operation.
O55 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE ELECTRONIC PARKING BRAKE MODULE C4205B	
• Measure the resistance between the electronic parking brake module C4205b-1, circuit 4-CG16 (GY/RD), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.	**Yes** GO to O62 . **No** GO to O56 .

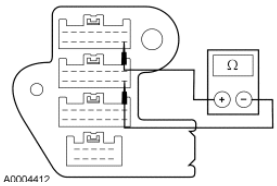
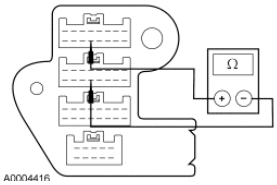
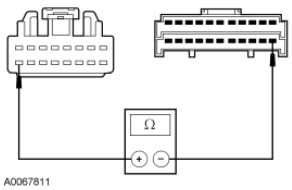
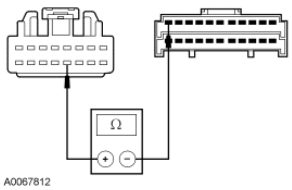
 A0057805 • Measure the resistance between the electronic parking brake module C4205b-7, circuit 5-CG16 (BU/RD), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0057810 • **Are the resistances less than 5 ohms?**	
O56 CHECK FOR AN OPEN BETWEEN JOINT CONNECTOR NO. 5 C427 AND THE ELECTRONIC PARKING BRAKE MODULE C4205B	
• Disconnect: Joint Connector No. 5 C427. • Measure the resistance between the electronic parking brake module C4205b-1, circuit 4-CG16 (GY/RD), harness side and joint connector No. 5 C427-2, circuit 4-CG16 (GY/RD), harness side.  A0067866 • Measure the resistance between the electronic parking brake module C4205b-7, circuit 5-CG16 (BU/RD), harness side and joint connector No. 5 C427-13, circuit 5-CG16 (BU/RD), harness side.  A0067867 • **Are the resistances less than 5 ohms?**	**Yes** GO to O57 . **No** REPAIR the circuit in question. TEST the system for normal operation.
O57 CHECK JOINT CONNECTOR NO. 5 C427 FOR AN OPEN	

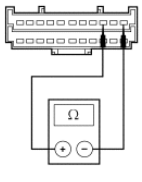
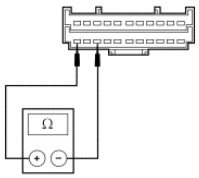
• Measure the resistance between joint connector No. 5 C427-1, component side and joint connector No. 5 C427-2, component side.  A0067868 • Measure the resistance between joint connector No. 5 C427-12, component side and joint connector No. 5 C427-13, component side.  A0067869 • **Are the resistances less than 5 ohms?**	**Yes** GO to O58 . **No** REPAIR joint connector No. 5 C427 as necessary. TEST the system for normal operation.
O58 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND JOINT CONNECTOR NO. 5 C427	
• Disconnect: Interior AJB C283b. • Measure the resistance between the interior AJB C283b-8, circuit 4-EG1 (GY/RD), harness side and joint connector No. 5 C427-1, circuit 4-EG1 (GY/RD), harness side.  A0067870 • Measure the resistance between the interior AJB C283b-4, circuit 5-EG1 (BU/RD), harness side and joint connector No. 5 C427-12, circuit 5-EG1 (BU/RD), harness side.  A0067871 • **Are the resistances less than 5 ohms?**	**Yes** GO to O59 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.
O59 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND THE INTERIOR AJB C283D	

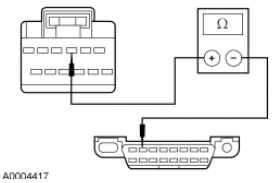
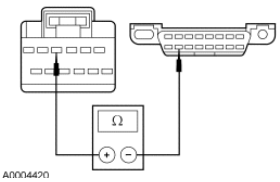
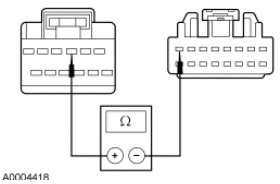
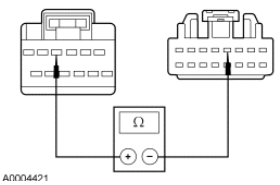
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283b-8, component side.  A0057792 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283b-4, component side.  A0057793 • **Are the resistances less than 5 ohms?**	**Yes** GO to O60 . **No** INSTALL a new interior AJB. TEST the system for normal operation.
O60 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0067872 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  A0067887 • **Are the resistances less than 5 ohms?**	**Yes** GO to O61 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

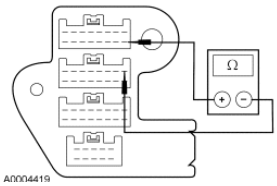
O61 CHECK JOINT CONNECTOR NO. 4 C223 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
O62 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE ELECTRONIC PARKING BRAKE C4205B DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O85 . **No** GO to O63 .
O63 CHECK THE DSM C341C FOR DAMAGE	
• Ignition OFF. • Connect: Electronic Parking Brake Module C4205b. • Connect: Interior AJB C283b. • Connect: Interior AJB C283c. • Connect: Joint Connector No. 4 C223. • Connect: Joint Connector No. 5 C427. • Disconnect: DSM C241c. • Inspect the DSM C341c for damage. • **Is the DSM C341c OK?**	**Yes** GO to O64 . **No** REPAIR the DSM C341c as necessary. TEST the system for normal operation.
O64 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE DSM C341C	
• Measure the resistance between the DSM C341c-1, circuit 4-AH80 (GY/WH), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.	**Yes** GO to O69 . **No** GO to O65 .

 A0004409 • Measure the resistance between the DSM C341c-9, circuit 5-AH80 (BU/OG), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0004413 • **Are the resistances less than 5 ohms?**	
O65 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283A AND THE DSM C341C	
• Disconnect: Interior AJB C283a. • Measure the resistance between the DSM C341c-1, circuit 4-AH80 (GY/WH), harness side and the interior AJB C283a-16, circuit 4-AH80 (GY/WH), harness side.  A0067951 • Measure the resistance between the DSM C341c-9, circuit 5-AH80 (BU/OG), harness side and the interior AJB C283a-12, circuit 5-AH80 (BU/OG), harness side.  A0004414 • **Are the resistances less than 5 ohms?**	**Yes** GO to O66 . **No** REPAIR the circuit in question. TEST the system for normal operation.
O66 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283A AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283a-16, component side and the interior AJB C283d-16, component side.	**Yes** GO to O67 . **No** INSTALL a new interior AJB. TEST

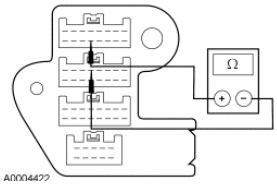
 A0004417 • Measure the resistance between the interior AJB C283a-12, component side and the interior AJB C283d-12, component side.  A0004416 • **Are the resistances less than 5 ohms?**	the system for normal operation.
O67 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0067811 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.  A0067812 • **Are the resistances less than 5 ohms?**	**Yes** GO to O68 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.
O68 CHECK JOINT CONNECTOR NO. 4 C223 FOR AN OPEN	

• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
O69 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE DSM C341C DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O86 . **No** GO to O70 .
O70 CHECK THE DDM C501A FOR DAMAGE	
• Ignition OFF. • Connect: DSM C341c. • Connect: Interior AJB C283a. • Connect: Interior AJB C283d. • Connect: Joint Connector No. 4 C223. • Disconnect: DDM C501a. • Inspect the DDM C501a for damage. • **Is the DDM C501a OK?**	**Yes** GO to O71 . **No** REPAIR the DDM C501a as necessary. TEST the system for normal operation.
O71 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE DDM C501A	
• Measure the resistance between the DDM C501a-3, circuit 4-EG13 (GY/OG), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.	**Yes** GO to O76 . **No** GO to O72 .

 A0004417 • Measure the resistance between the DDM C501a-4, circuit 5-EG13 (BU/BK), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0004420 • **Are the resistances less than 5 ohms?**	
O72 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283A AND THE DDM C501A	
• Disconnect: Interior AJB C283a. • Measure the resistance between the DDM C501a-3, circuit 4-EG13 (GY/OG), harness side and the interior AJB C283a-8, circuit 4-EG13 (GY/OG), harness side.  A0004418 • Measure the resistance between the DDM C501a-4, circuit 5-EG13 (BU/BK), harness side and the interior AJB C283a-4, circuit 5-EG13 (BU/BK), harness side.  A0004421 • **Are the resistances less than 5 ohms?**	**Yes** GO to O73 . **No** REPAIR the circuit in question. TEST the system for normal operation.
O73 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283A AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283a-8, component side.	**Yes** GO to O74 . **No** INSTALL a new interior AJB. TEST the system for normal operation.

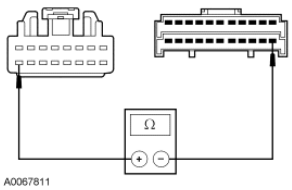


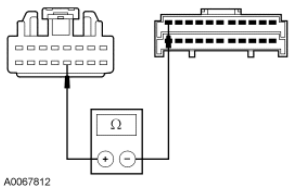
- Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283a-4, component side.

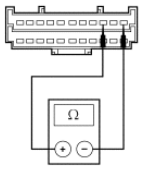
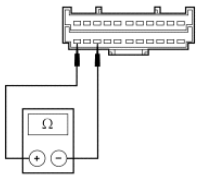


- **Are the resistances less than 5 ohms?**

O74 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side. • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side. • **Are the resistances less than 5 ohms?**	**Yes** GO to O75 . **No** REPAIR the circuit in question. TEST the system for normal operation.
O75 CHECK JOINT CONNECTOR NO. 4 C223 FOR AN OPEN	





• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C223-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
O76 CHECK THE SCP COMMUNICATIONS NETWORK WITH THE DDM C501A DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to O87 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
O77 CHECK FOR CORRECT PCM OPERATION	

• Disconnect all the PCM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the PCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

O78 CHECK FOR CORRECT ABS/TC MODULE OPERATION	
• Disconnect all the ABS/TC module connectors.	**Yes** INSTALL a new ABS/TC module.

• Check for: • corrosion • push-out pins • Connect all the ABS/TC module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	REFER to Section 206-09 . TEST the system for normal operation. CARRY OUT the diagnostic tool data link test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
O79 CHECK FOR CORRECT DATC MODULE OPERATION	
• Disconnect all the DATC module connectors. • Check for: • corrosion • push-out pins • Connect all the DATC module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DATC module. REFER to Section 412-01 . TEST the system for normal operation. CARRY OUT the diagnostic tool data link test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
O80 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
• Disconnect all the instrument cluster connectors. • Check for: • corrosion • push-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. CARRY OUT the diagnostic tool data link test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
O81 CHECK FOR CORRECT NAVIGATION SYSTEM MODULE OPERATION	
• Disconnect all the navigation system module connectors. • Check for: • corrosion • push-out pins • Connect all the navigation system module connectors and make sure they seat correctly.	**Yes** INSTALL a new navigation system module. REFER to Section 415-00 . TEST the system for normal operation. CARRY OUT the diagnostic tool

• Operate the system and verify the concern is still present. • **Is the concern still present?**	data link test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
O82 CHECK FOR CORRECT ACM OPERATION	

• Disconnect all the ACM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the ACM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new ACM. REFER to Section 415-00 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

O83 CHECK FOR CORRECT REM OPERATION	

• Disconnect all the REM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the REM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new REM. REFER to Section 419-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

O84 CHECK FOR CORRECT FEM OPERATION	

• Disconnect all the FEM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the FEM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

O85 CHECK FOR CORRECT ELECTRONIC PARKING BRAKE MODULE OPERATION	

• Disconnect all the electronic parking brake module connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the electric parking brake module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new electronic parking brake module. REFER to Section 206-05 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

O86 CHECK FOR CORRECT DSM OPERATION	

• Disconnect all the DSM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the DSM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DSM. REFER to Section 419-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

O87 CHECK FOR CORRECT DDM OPERATION	

• Disconnect all the DDM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the DDM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new DDM. REFER to Section 419-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test P: No International Standards Organization (ISO) 9141 Communications Network Communication

Normal Operation

The restraints control module (RCM) communicates with the diagnostic tool through the ISO 9141 communications network circuit 4-EE1 (GY/RD). If circuit 4-EE1 (GY/RD) becomes open or shorted to ground, communications to that module are not possible. Check circuit 4-EE1 (GY/RD) between the RCM C310a and the data link connector (DLC) C251. The total resistance value must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuit 4-EE1 (GY/RD), damage to the DLC C251, in-line C212 or damage to the RCM C310a.

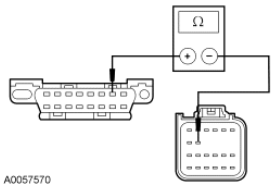
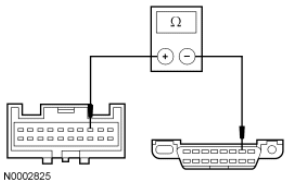
Possible Causes

- ISO 9141 circuit 4-EE1 (GY/RD) short to ground or open
- in-line C212
- DLC C251
- RCM C310a
- RCM

PINPOINT TEST P: NO INTERNATIONAL STANDARDS ORGANIZATION (ISO) 9141 COMMUNICATIONS NETWORK COMMUNICATION

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
P1 CHECK THE DLC C251 FOR DAMAGE	
• Ignition OFF. • Inspect the DLC C251. • **Is the DLC C251 OK?**	**Yes** GO to P2 . **No** REPAIR the DLC C251. CARRY OUT the diagnostic tool data link test.
P2 CHECK THE RCM C310A FOR DAMAGE	
• Deactivate the air bag system. Refer to Section 501-20B . • Disconnect: RCM C310a. • Inspect the RCM C310a for damage. • **Is the RCM C310a OK?**	**Yes** GO to P3 . **No** REPAIR the RCM C310a as necessary. TEST the system for normal operation.
P3 CHECK FOR AN OPEN CIRCUIT BETWEEN THE RCM C310A AND THE DLC C251	
• Measure the resistance between the DLC C251-7, circuit 4-EE10 (GY/BK), harness side and the RCM C310a-11, circuit 4-EE1 (GY/RD), harness side.	**Yes** GO to P5 . **No** GO to P4 .

 A0057570 • **Is the resistance less than 5 ohms?**	
P4 CHECK FOR AN OPEN CIRCUIT BETWEEN DLC C251 AND IN-LINE C212M	
• Disconnect: In-Line C212. • Measure the resistance between the DLC C251-7, circuit 4-EE10 (GY/BK), harness side and in-line C212M-8, circuit 4-EE10 (GY/BK), harness side.  N0002825 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit between the RCM C310a and in-line C212F. REACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation. **No** REPAIR the circuit between the DLC C251 and in-line C212M. REACTIVATE the air bag system. REFER to Section 501-20B . TEST the system for normal operation.
P5 CHECK THE ISO 9141 COMMUNICATIONS NETWORK WITH THE RCM C310A DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to P6 . **No** GO to P6 .
P6 CHECK FOR CORRECT RCM OPERATION	

• Disconnect all the RCM connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the RCM connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new RCM. REFER to Section 501-20B . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REACTIVATE the air bag system. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test Q: No Universal Asynchronous Receiver-Transmitter (UART)-Based Protocol (UBP) Communications Network Communication

Normal Operation

The driver climate control seat module, passenger climate control seat module, and parking aid module communicate with the diagnostic tool through the UBP communications network circuit 4-ED6 (OG). If circuit 4-ED6 (OG) becomes open or shorted to ground, communications to that module are not possible. Check circuit 4-ED6 (OG) between the driver climate control seat module, passenger climate control seat module, parking aid module, and the data link connector (DLC) C251. The total resistance value must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuit 4-ED6 (OG), damage to the DLC C251 or damage to the driver or passenger climate control seat module, parking aid module, or a problem with in-line C213, in-line C313, in-line C315 or joint connector No. 1 C261.

If, after individual checks of each circuit leading to a module show resistance values less than 5 ohms, and no in-line connector issues are present, the data link diagnostics test must be run with the module in question disconnected. If the data link diagnostics test passes with the module in question disconnected, it is the source of the concern and should be removed and a new module installed.

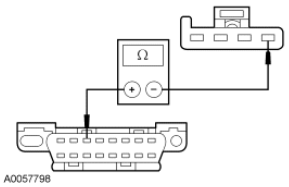
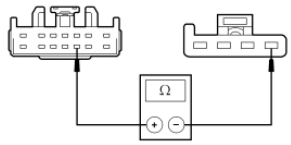
Possible Causes

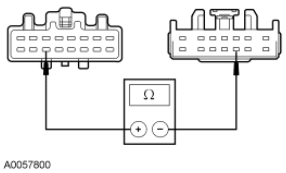
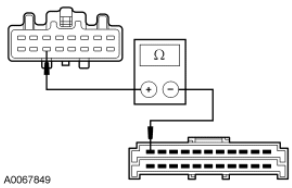
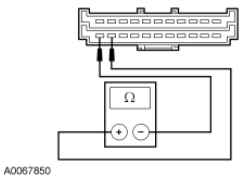
- UBP circuit 4-ED6 (OG) open or short to ground
- DLC C251
- in-line C213
- in-line C313
- in-line C315
- joint connector No. 1 C261
- driver temperature control seat module
- passenger temperature control seat module
- parking aid module

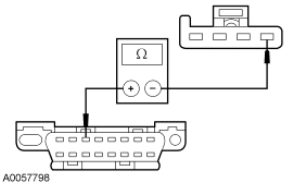
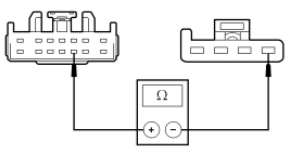
PINPOINT TEST Q: NO UNIVERSAL ASYNCHRONOUS RECEIVER-TRANSMITTER (UART)-BASED PROTOCOL (UBP) COMMUNICATIONS NETWORK COMMUNICATION

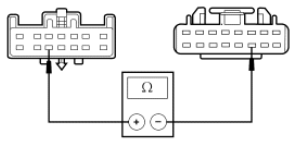
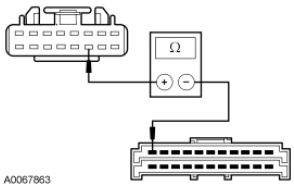
⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

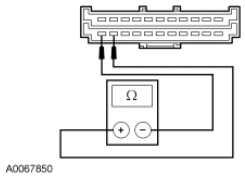
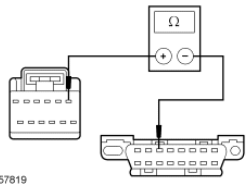
Test Step	Result / Action to Take
Q1 CHECK THE DRIVER TEMPERATURE CONTROL SEAT MODULE C3031A FOR DAMAGE	
• Ignition OFF. • Disconnect: Driver Temperature Control Seat Module C3031a. • Inspect the driver temperature control seat module C3031a for damage. • **Is the driver temperature control seat module C3031a OK?**	**Yes** GO to Q2 . **No** REPAIR the driver temperature control seat module C3031a. CARRY OUT the diagnostic tool data link test.
Q2 CHECK CIRCUIT 4-HC21 (GY/OG) BETWEEN DLC C251 AND THE DRIVER TEMPERATURE CONTROL SEAT MODULE C3031A FOR AN OPEN	
• Measure the resistance between the driver temperature control seat module C3031a-1, circuit 4-HC21 (GY/OG), harness side and the DLC C251-3, circuit 4-ED6 (GY), harness side.	**Yes** GO to Q9 . **No** GO to Q3 .

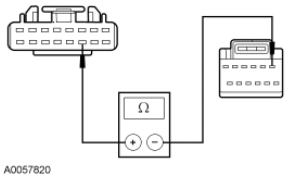
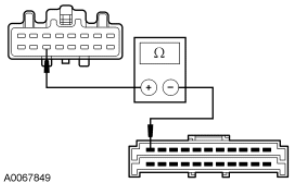
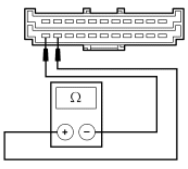
 A0057798 • **Is the resistance less than 5 ohms?**	
Q3 CHECK IN-LINE C315 FOR DAMAGE	
• Disconnect: In-Line C315. • Inspect in-line C315M and in-line C315F for damage. • **Are in-line C315M and in-line C315F OK?**	**Yes** GO to Q4 . **No** REPAIR in-line C315M and in-line C315F. CARRY OUT the diagnostic tool data link test.
Q4 CHECK CIRCUIT 4-HC21 (GY/OG) BETWEEN IN-LINE C315F AND THE DRIVER TEMPERATURE CONTROL SEAT MODULE C3031A FOR AN OPEN	
• Measure the resistance between the driver temperature control seat module C3031a-1, circuit 4-HC21 (GY/OG), harness side and in-line C315F-10, circuit 4-HC21 (GY/OG), harness side.  A0057799 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q5 . **No** REPAIR the circuit between in-line C315F and the driver temperature control seat module C3031a. CARRY OUT the diagnostic tool data link test.
Q5 CHECK IN-LINE C213 FOR DAMAGE	
• Disconnect: In-Line C213. • Inspect in-line C213M and in-line C213F for damage. • **Are in-line C213M and in-line C213F OK?**	**Yes** GO to Q6 . **No** REPAIR in-line C213M and in-line C213F. CARRY OUT the diagnostic tool data link test.
Q6 CHECK CIRCUIT 4-HC21 (GY/OG) BETWEEN IN-LINE C315M AND IN-LINE C213F FOR AN OPEN	
• Measure the resistance between in-line C213F-11, circuit 4-HC1 (GY/RD), harness side and in-line C315M-10, circuit 4-HC21 (GY/OG), harness side.	**Yes** GO to Q7 . **No** REPAIR the circuit between in-line C315M and in-line C213F. CARRY OUT the diagnostic tool data link test.

 A0057800 • **Is the resistance less than 5 ohms?**	
Q7 CHECK CIRCUIT 4-HC1 (GY/RD) BETWEEN IN-LINE C213M AND JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Measure the resistance between in-line C213M-11, circuit 4-HC1 (GY/RD), harness side and joint connector No. 1 C261-11, circuit 4-HC1 (GY/RD), harness side.  A0067849 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q8 . **No** REPAIR the circuit between in-line C213M and joint connector No. 1 C261. CARRY OUT the diagnostic tool data link test.
Q8 CHECK JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Measure the resistance between joint connector No. 1 C261-10, component side and joint connector No. 1 C261-11, component side.  A0067850 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit between joint connector No. 1 C261 and the DLC C251. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 1 C261 as necessary. CARRY OUT the diagnostic tool data link test.
Q9 CHECK THE UBP COMMUNICATIONS NETWORK WITH THE DRIVER CLIMATE CONTROL SEAT MODULE DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to Q26 . **No** GO to Q10 .
Q10 CHECK THE PASSENGER TEMPERATURE CONTROL SEAT MODULE C3036A FOR DAMAGE	
• Ignition OFF. • Connect: Driver Temperature Control Seat Module C3031a. • Connect: In-Line C315.	**Yes** GO to Q11 . **No** REPAIR the passenger temperature

• Connect: In-Line C213. • Connect: Joint Connector No. 1 C261. • Disconnect: Passenger Temperature Control Seat Module C3036a. • Inspect the passenger temperature control seat module C3036a for damage. • **Is the passenger temperature control seat module C3036a OK?**	control seat module C3036a. CARRY OUT the diagnostic tool data link test.
Q11 CHECK CIRCUIT 4-HC22 (GY) BETWEEN THE DLC C251 AND THE PASSENGER TEMPERATURE CONTROL SEAT MODULE C3036A FOR AN OPEN	
• Measure the resistance between the passenger temperature control seat module C3036a-1, circuit 4-HC22 (GY), harness side and the DLC C251-3, circuit 4-ED6 (GY), harness side.  A0057798 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q18 . **No** GO to Q12 .
Q12 CHECK IN-LINE C313 FOR DAMAGE	
• Disconnect: In-Line C313. • Inspect in-line C313M and in-line C313F for damage. • **Are in-line C313M and in-line C313F OK?**	**Yes** GO to Q13 . **No** REPAIR in-line C313M and in-line C313F. CARRY OUT the diagnostic tool data link test.
Q13 CHECK CIRCUIT 4-HC22 (GY) BETWEEN IN-LINE C313F AND THE PASSENGER TEMPERATURE CONTROL SEAT MODULE C3036A FOR AN OPEN	
• Measure the resistance between the passenger temperature control seat module C3036a-1, circuit 4-HC22 (GY), harness side and in-line C313F-10, circuit 4-HC22 (GY), harness side.  A0057799 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q14 . **No** REPAIR the circuit between in-line C313F and the passenger temperature control seat module C3036a. CARRY OUT the diagnostic tool data link test.
Q14 CHECK IN-LINE C213 FOR DAMAGE	

• Disconnect: In-Line C213. • Inspect in-line C213M and in-line C213F for damage. • **Are in-line C213M and in-line C213F OK?**	**Yes** GO to Q15 . **No** REPAIR in-line C213M and in-line C213F. CARRY OUT the diagnostic tool data link test.
Q15 CHECK CIRCUIT 4-HC22 (GY) BETWEEN IN-LINE C313M AND IN-LINE C213F FOR AN OPEN	
• Measure the resistance between in-line C213F-11, circuit 4-HC1 (GY/RD), harness side and in-line C313M-10, circuit 4-HC22 (GY), harness side.  A0057803 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q16 . **No** REPAIR the circuit between in-line C313M and in-line C213F. CARRY OUT the diagnostic tool data link test.
Q16 CHECK CIRCUIT 4-HC1 (GY/RD) BETWEEN IN-LINE C213F AND JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Disconnect: C261. • Measure the resistance between in-line C213F-11, circuit 4-HC1 (GY/RD), harness side and joint connector No. 1 C261-11, circuit 4-HC1 (GY/RD), harness side.  A0067863 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q17 . **No** REPAIR the circuit between in-line C213F and joint connector No. 1 C261. CARRY OUT the diagnostic tool data link test.
Q17 CHECK JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Measure the resistance between joint connector No. 1 C261-10, component side and joint connector No. 1 C261-11, component side.	**Yes** REPAIR the circuit between joint connector No. 1 C261 and the DLC C251. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 1 C261 as necessary. CARRY OUT the diagnostic tool data link test.

 A0067850 • **Is the resistance less than 5 ohms?**	
Q18 CHECK THE UBP COMMUNICATIONS NETWORK WITH THE PASSENGER CLIMATE CONTROL SEAT MODULE DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test. • **Does the diagnostic tool indicate system passed?**	**Yes** GO to Q27 . **No** GO to Q19 .
Q19 CHECK THE PARKING AID MODULE C4014B FOR DAMAGE	
• Ignition OFF. • Connect: Passenger Temperature Control Seat Module C3036a. • Connect: In-Line C313. • Connect: In-Line C213. • Connect: Joint Connector No. 1 C261. • Disconnect: Parking Aid Module C4014b. • Inspect the parking aid module C4014b for damage. • **Is the parking aid module C4014b OK?**	**Yes** GO to Q20 . **No** REPAIR the parking aid module C4014b. CARRY OUT the diagnostic tool data link test.
Q20 CHECK CIRCUIT 4-GN10 (GY) BETWEEN THE DLC C251 AND THE PARKING AID MODULE C4014B FOR AN OPEN	
• Measure the resistance between the parking aid module C4014b-1, circuit 4-GN10 (GY), harness side and the DLC C251-3, circuit 4-ED6 (GY), harness side.  A0057819 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q25 . **No** GO to Q21 .
Q21 CHECK IN-LINE C213 FOR DAMAGE	
• Disconnect: In-Line C213. • Inspect in-line C213M and in-line C213F for damage. • **Are in-line C213M and in-line C213F OK?**	**Yes** GO to Q22 . **No** REPAIR in-line C213M and in-line C213F. CARRY OUT the diagnostic tool data link test.
Q22 CHECK CIRCUIT 4-GN10 (GY) BETWEEN THE PARKING AID MODULE C4014B AND IN-LINE C213F	

FOR AN OPEN	
• Measure the resistance between in-line C213F-11, circuit 4-HC1 (GY/RD), harness side and the parking aid module C4014b-1, circuit 4-GN10 (GY), harness side.  A0057820 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q23 . **No** REPAIR the circuit between the parking aid module C4014b and in-line C213F. CARRY OUT the diagnostic tool data link test.
Q23 CHECK CIRCUIT 4-HC1 (GY/RD) BETWEEN IN-LINE C213M AND JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Disconnect: joint connector No. 1 C261. • Measure the resistance between in-line C213M-11, circuit 4-HC1 (GY/RD), harness side and joint connector No. 1 C261-11, circuit 4-HC1 (GY/RD), harness side.  A0067849 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q24 . **No** REPAIR the circuit between in-line C213M and joint connector No. 1 C261. CARRY OUT the diagnostic tool data link test.
Q24 CHECK JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Measure the resistance between joint connector No. 1 C261-10, component side and joint connector No. 1 C261-11, component side.  A0067850 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit between joint connector No. 1 C261 and the DLC C251. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 1 C261 as necessary. CARRY OUT the diagnostic tool data link test.
Q25 CHECK THE UBP COMMUNICATIONS NETWORK WITH THE PARKING AID MODULE DISCONNECTED	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Data Link Diagnostics Test.	**Yes** GO to Q28 . **No**

• **Does the diagnostic tool indicate system passed?**	GO to Q26 .
Q26 CHECK FOR CORRECT DRIVER TEMPERATURE CONTROL SEAT MODULE OPERATION	

• Disconnect all the driver temperature control seat module connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the driver temperature control seat module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new driver temperature control seat module. REFER to Section 501-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Q27 CHECK FOR CORRECT PASSENGER TEMPERATURE CONTROL SEAT MODULE OPERATION	

• Disconnect all the passenger temperature control seat module connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the passenger temperature control seat module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new passenger temperature control seat module. REFER to Section 501-10 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Q28 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect all the parking aid module connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the parking aid module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Section 413-13 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test R: The Electronic Parking Brake Module Does Not Respond To The Diagnostic Tool

Normal Operation

The electronic parking brake module communicates with the diagnostic tool through the standard corporate protocol (SCP) communications network circuits 4-CG16 (GY/RD) and 5-CG16 (BU/RD). If one of the SCP communications network circuits become shorted to ground or voltage, or if some but not all termination resistors are lost, communications can continue. Check circuits 4-CG16 (GY/RD) and 5-CG16 (BU/RD) between the electronic parking brake module C4205b and the data link connector (DLC) C251. The total resistance values must not be more than 5 ohms.

If the resistance is more than 5 ohms, there is either an open in circuit 4-CG16 (GY/RD) and 5-CG16 (BU/RD), damage to the DLC C251, damage to the electronic parking brake module C4205b, or a problem in the interior auxiliary junction box (AJB) C283b, interior AJB C283d, joint connector No. 5 C427 or joint connector No. 4 C223.

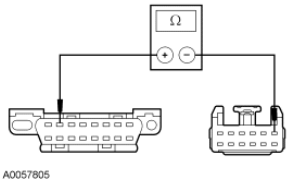
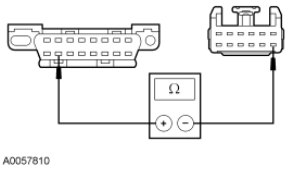
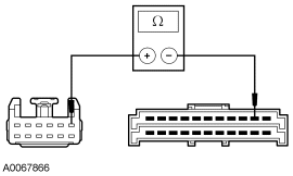
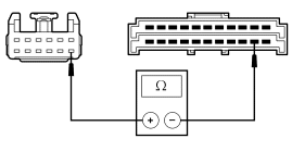
Possible Causes

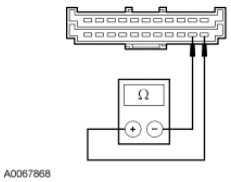
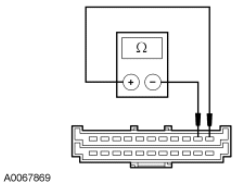
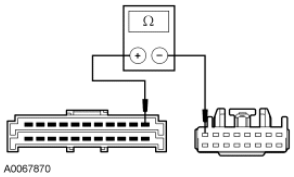
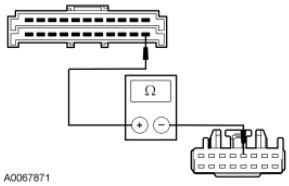
- SCP data plus circuit 4-CG16 (GY/RD) open
- SCP data minus circuit 5-CG16 (BU/RD) open
- joint connector No. 4 C223
- DLC C251
- interior AJB C283b
- interior AJB C283d
- joint connector No. 5 C427
- electronic parking brake module C4205b
- electronic parking brake module

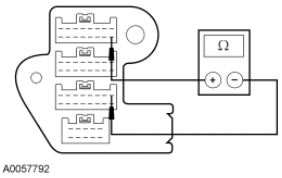
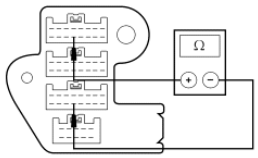
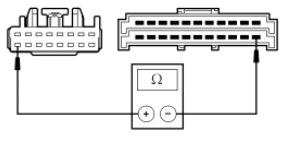
PINPOINT TEST R: THE ELECTRONIC PARKING BRAKE MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

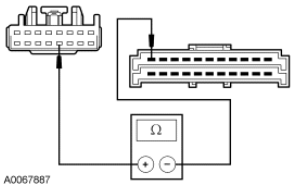
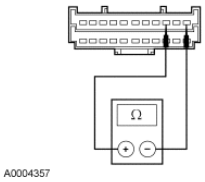
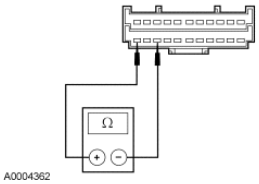
⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
R1 CHECK THE ELECTRONIC PARKING BRAKE MODULE C4205B FOR DAMAGE	
• Ignition OFF. • Disconnect: Electronic Parking Brake Module C4205b. • Inspect the electronic parking brake module C4205b for damage. • **Is the electronic parking brake module C4205b OK?**	**Yes** GO to R2 . **No** REPAIR the electronic parking brake module C4205b as necessary. TEST the system for normal operation.
R2 CHECK FOR AN OPEN BETWEEN THE DLC C251 AND THE ELECTRONIC PARKING BRAKE MODULE C4205B	
• Measure the resistance between the electronic parking brake module C4205b-1, circuit 4-CG16 (GY/RD), harness side and the DLC C251-2, circuit 4-EG7 (GY/RD), harness side.	**Yes** GO to R9 . **No** GO to R3 .

 A0057805 • Measure the resistance between the electronic parking brake module C4205b-7, circuit 5-CG16 (BU/RD), harness side and the DLC C251-10, circuit 5-EG7 (BU/RD), harness side.  A0057810 • **Are the resistances less than 5 ohms?**	
R3 CHECK FOR AN OPEN BETWEEN JOINT CONNECTOR NO. 5 C427 AND THE ELECTRONIC PARKING BRAKE MODULE C4205B	
• Disconnect: Joint Connector No. 5 C427. • Measure the resistance between the electronic parking brake module C4205b-1, circuit 4-CG16 (GY/RD), harness side and joint connector No. 5 C427-2, circuit 4-CG16 (GY/RD), harness side.  A0067866 • Measure the resistance between the electronic parking brake module C4205b-7, circuit 5-CG16 (BU/RD), harness side and joint connector No. 5 C427-13, circuit 5-CG16 (BU/RD), harness side.  A0067867 • **Are the resistances less than 5 ohms?**	**Yes** GO to R4 . **No** REPAIR the circuit in question. TEST the system for normal operation.
R4 CHECK JOINT CONNECTOR NO. 5 C427 FOR AN OPEN	

• Measure the resistance between joint connector No. 5 C427-1, component side and joint connector No. 5 C427-2, component side.  A0067868 • Measure the resistance between joint connector No. 5 C427-12, component side and joint connector No. 5 C427-13, component side.  A0067869 • **Are the resistances less than 5 ohms?**	**Yes** GO to R5 . **No** REPAIR joint connector No. 5 C427 as necessary. TEST the system for normal operation.
R5 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND JOINT CONNECTOR NO. 5 C427	
• Disconnect: Interior AJB C283b. • Measure the resistance between the interior AJB C283b-8, circuit 4-EG1 (GY/RD), harness side and joint connector No. 5 C427-1, circuit 4-EG1 (GY/RD), harness side.  A0067870 • Measure the resistance between the interior AJB C283b-4, circuit 5-EG1 (BU/RD), harness side and joint connector No. 5 C427-12, circuit 5-EG1 (BU/RD), harness side.  A0067871 • **Are the resistances less than 5 ohms?**	**Yes** GO to R6 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

R6 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283B AND THE INTERIOR AJB C283D	
• Disconnect: Interior AJB C283d. • Measure the resistance between the interior AJB C283d-16, component side and the interior AJB C283b-8, component side.  A0057792 • Measure the resistance between the interior AJB C283d-12, component side and the interior AJB C283b-4, component side.  A0057793 • **Are the resistances less than 5 ohms?**	**Yes** GO to R7 . **No** INSTALL a new interior AJB. TEST the system for normal operation.
R7 CHECK FOR AN OPEN BETWEEN THE INTERIOR AJB C283D AND JOINT CONNECTOR NO. 4 C223	
• Disconnect: Joint Connector No. 4 C223. • Measure the resistance between the interior AJB C283d-16, circuit 4-EG1 (GY/RD), harness side and joint connector No. 4 C223-12, circuit 4-EG1 (GY/RD), harness side.  A0067872 • Measure the resistance between the interior AJB C283d-12, circuit 5-EG1 (BU/RD), harness side and joint connector No. 4 C223-11, circuit 5-EG1 (BU/RD), harness side.	**Yes** GO to R8 . **No** REPAIR the circuit in question. CARRY OUT the diagnostic tool data link test.

 A0067887 • **Are the resistances less than 5 ohms?**	
R8 CHECK JOINT CONNECTOR NO. 4 C427 FOR AN OPEN	
• Measure the resistance between joint connector No. 4 C223-12, component side and joint connector No. 4 C233-14, component side.  A0004357 • Measure the resistance between joint connector No. 4 C223-9, component side and joint connector No. 4 C223-11, component side.  A0004362 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the circuit in question between the DLC C251 and joint connector No. 4 C223. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 4 C223. TEST the system for normal operation.
R9 CHECK FOR CORRECT ELECTRONIC PARKING BRAKE MODULE OPERATION	

• Disconnect all the electronic parking brake module connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the electronic parking brake module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new electronic parking brake module. REFER to Section 206-05 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test S: The Parking Aid Module Does Not Respond To The Diagnostic Tool

Normal Operation

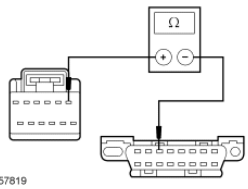
The parking aid module communicates with the diagnostic tool through the universal asynchronous receiver-transmitter (UART)-based protocol (UBP) communications network circuit 4-GN10 (GY). If circuit 4-GN10 (GY) becomes open or shorted to ground, communications to that module are not possible. Check circuit 4-GN10 (GY) between the parking aid module C4014b and the data link connector (DLC) C251. The total resistance value must not be more than 5 ohms. If the resistance is more than 5 ohms, there is either an open in circuit 4-GN10 (GY), damage to the DLC C251, damage to the parking aid module C4014b, or a problem in the in-line C213 or joint connector No. 1 C261.

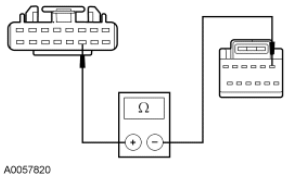
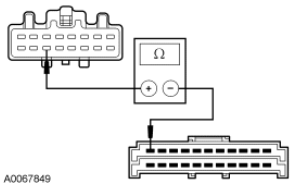
Possible Causes

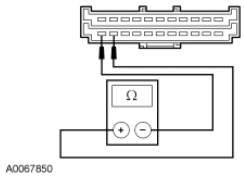
- UBP circuit 4-GN10 (GY) short to ground or open
- in-line C213
- DLC C251
- joint connector No. 1 C261
- parking aid module C4014b
- parking aid module

PINPOINT TEST S: THE PARKING AID MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
S1 CHECK THE PARKING AID MODULE C4014B FOR DAMAGE	
• Ignition OFF. • Disconnect: Parking Aid Module C4014b. • Inspect the parking aid module C4014b for damage. • **Is the parking aid module C4014b OK?**	**Yes** GO to S2 . **No** REPAIR the parking aid module C4014b. CARRY OUT the diagnostic tool data link test.
S2 CHECK CIRCUIT 4-GN10 (GY) BETWEEN THE DLC C251 AND THE PARKING AID MODULE C4014B FOR AN OPEN	
• Measure the resistance between the parking aid module C4014b-1, circuit 4-GN10 (GY), harness side and the DLC C251-3, circuit 4-ED6 (GY), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to S7 . **No** GO to S3 .
S3 CHECK IN-LINE C213 FOR DAMAGE	

• Disconnect: In-Line C213. • Inspect in-line C213M and in-line C213F for damage. • **Are in-line C213M and in-line C213F OK?**	**Yes** GO to S4 . **No** REPAIR in-line C213M and in-line C213F. CARRY OUT the diagnostic tool data link test.
S4 CHECK CIRCUIT 4-GN10 (GY) BETWEEN THE PARKING AID MODULE C4014B AND IN-LINE C213F FOR AN OPEN	
• Measure the resistance between in-line C213F-11, circuit 4-HC1 (GY/RD), harness side and the parking aid module C4014b-1, circuit 4-GN10 (GY), harness side.  A0057820 • **Is the resistance less than 5 ohms?**	**Yes** GO to S5 . **No** REPAIR the circuit between the parking aid module C4014B and in-line C213F. CARRY OUT the diagnostic tool data link test.
S5 CHECK CIRCUIT 4-HC1 (GY/RD) BETWEEN IN-LINE C213M AND JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Disconnect: Joint Connector No. 1 C261. • Measure the resistance between in-line C213M-11, circuit 4-HC1 (GY/RD), harness side and joint connector No. 1 C261-11, circuit 4-HC1 (GY/RD), harness side.  A0067849 • **Is the resistance less than 5 ohms?**	**Yes** GO to S6 . **No** REPAIR the circuit between in-line C213M and joint connector No. 1 C261. CARRY OUT the diagnostic tool data link test.
S6 CHECK JOINT CONNECTOR NO. 1 C261 FOR AN OPEN	
• Measure the resistance between joint connector No. 1 C261-10, component side and joint connector No. 1 C261-11, component side.	**Yes** REPAIR the circuit between joint connector No. 1 C261 and the DLC C251. CARRY OUT the diagnostic tool data link test. **No** REPAIR joint connector No. 1 C261 as

 • **Is the resistance less than 5 ohms?**	necessary. CARRY OUT the diagnostic tool data link test.
S7 CHECK FOR CORRECT PARKING AID MODULE OPERATION	

• Disconnect all the parking aid module connectors.
• Check for:
  • corrosion
  • push-out pins
• Connect all the parking aid module connectors and make sure they seat correctly.
• Operate the system and verify the concern is still present.
• **Is the concern still present?**
	Yes
	INSTALL a new parking aid module. REFER to Section 413-13 . TEST the system for normal operation.
	
	CARRY OUT the diagnostic tool data link test.
	
	No
	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test T: No Module/Network Communication — No Power To The Diagnostic Tool

Normal Operation

Under normal operation the diagnostic tool is connected to the data link connector (DLC) C251 to communicate with the standard corporate protocol (SCP) communications network, universal asynchronous receiver-transmitter (UART)-based protocol (UBP) communications network, and the international standards organization (ISO) 9141 communications network. If communication cannot be established, the diagnostic tool and the DLC C251 must be checked for damage. If the diagnostic tool and the DLC C251 are OK, circuit 29-ED6 (OG/YE) must be checked for voltage and 31-ED6 (BK/YE), and 91-ED6 (BN) must be checked for an open condition.

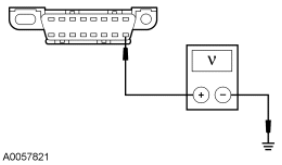
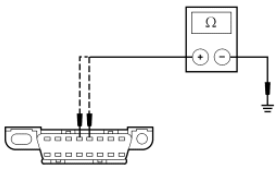
Possible Causes

- fuse
- DLC C251
- diagnostic tool
- circuit 29-ED6 (OG/YE) open
- circuit 31-ED6 (BK/YE) open
- circuit 91-ED6 (BN) open

PINPOINT TEST T: NO MODULE/NETWORK COMMUNICATION — NO POWER TO THE DIAGNOSTIC TOOL

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connector.

Test Step	Result / Action to Take
T1 CHECK THE DIAGNOSTIC TOOL CONNECTOR	

• Inspect the diagnostic tool pins for damage. • **Are the pins OK?**	**Yes** GO to T2 . **No** REPAIR the diagnostic tool connector. TEST the system for normal operation.
T2 CHECK THE DLC C251 FOR DAMAGE	
• Ignition OFF. • Inspect the DLC C251 pins for damage. • **Are the pins OK?**	**Yes** GO to T3 . **No** REPAIR the DLC C251. TEST the system for normal operation.
T3 CHECK THE VOLTAGE TO THE DIAGNOSTIC TOOL CIRCUIT 29-ED6 (OG/YE)	
• Measure the voltage between the DLC C251-16, circuit 29-ED6 (OG/YE), harness side and ground.  A0057821 • **Is the voltage greater than 10 volts?**	**Yes** GO to T4 . **No** VERIFY the CJB fuse 6 (10A) is OK. If OK, REPAIR the supply circuit. TEST the system for normal operation.
T4 CHECK THE DLC GROUND CIRCUIT 31-ED6 (BK/YE), AND CIRCUIT 91-ED6 (BN)	
• Measure the resistance between the DLC C251-4, circuit 31-ED6 (BK/YE), harness side and ground and between the DLC C251-5, circuit 91-ED6 (BN), harness side and ground.  A0057822 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the diagnostic tool. TEST the system for normal operation. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

Module Configuration

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Principles of Operation

Some modules must be programmed as part of the repair procedure. If this procedure is not followed, the module does not function correctly and may set a number of diagnostic trouble codes (DTCs), including B2477 or P1639, which indicate that necessary data has not been programmed into the module.

NOTE: The vehicle must be stationary and level, with all accessories off, while configuring modules.

Modules that need programming should not be exchanged between vehicles. In most cases the parameter values or settings are unique to that vehicle, and if not set correctly, cause concerns or faults.

The diagnostic tool automatically attempts to retrieve the module configuration information from all modules and from a backup location in the powertrain control module (PCM) when vehicle ID is carried out. If the module and the PCM do not contain correct information, the diagnostic tool either requests As-Built data or displays a list of items that are needed to be manually configured. The diagnostic tool programs the module based on the data entered.

For additional diagnostic tool programming procedures, refer to Programmable Module Installation in this section.

There are 3 different methods that are used for module programming:

- programmable module installation (PMI)
- calibration update
- programmable parameters

Some modules do not support all 3 methods.

Definition of Terms

Programmable Module Installation (PMI)

The PMI method is used when a new programmable module is installed on the vehicle. It is no longer necessary to command the diagnostic tool to gather module option content from the old module. The diagnostic tool automatically obtains any available module option content information from the old module during the vehicle ID routine that runs when the diagnostic tool is initially connected to the vehicle. It is important that the diagnostic tool is connected to the vehicle and allowed to identify the vehicle and obtain configuration data prior to any module removal.

If a module that has been modified using programmable parameters needs to be installed, the PMI procedure maintains the parameters in their altered state if the diagnostic tool is able to communicate with the old module during vehicle ID. Otherwise, you may need to use programmable parameters to return parameters to the altered state.

Calibration Update

Some modules are designed to be flashed or reflashed with completely new software packages. This process of reflashing the module is a calibration update.

A calibration update should be carried out only upon notification (such as a Technical Service Bulletin [TSB]). Also, if a module sets DTC U2050, this indicates no application is present and reflashing of the software application is required. If a module sets DTC U2051, this indicates no calibration is present and reflashing of calibration is required.

Programmable Parameters

These are options contained within the existing software. These include items such as tire size, customer preference items, and anti-theft options. The current settings are downloaded from an existing module then uploaded to a new module. They can also be configured using the diagnostic tool. Programming parameters is different from updating calibrations as no software is changed, only the options already contained in the software.

Vehicle Identification (VID) Block

Some PCMs contain a memory area called a VID block.

The PCM VID block may contain the factory settings for the configurable modules unless the PCM is flashed with a new calibration, in which case some PCM parameters may be modified.

As-Built Data Center

The As-Built Data Center maintains a record of the vehicle configuration in a database. The vehicle identification number (VIN) is necessary to obtain this information. The As-Built Data Center records the applicable module configurations stored in each module before the vehicle leaves the factory. The As-Built Data Center data always reflects the original build of the vehicle as it left the factory. Contact the As-Built Data Center only when directed to do so by the diagnostic tool.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Wiring harness • Connectors

Configurable Modules

The vehicle contains the following modules that are configurable:

- anti-lock brake system/traction control (ABS/TC) module or stability assist module (if equipped)
- audio control module (ACM)
- driver climate control seat module
- driver door module (DDM)
- dual automatic temperature control (DATC)
- electronic parking brake
- front electronics module (FEM)
- instrument cluster
- message center
- navigation system module
- passenger climate control seat module
- PCM
- rear electronics module (REM)

Programmable Parameters Index

Module	Calibration Updatable	PMI	Programmable Parameter
ABS/TC Module or Stability Assist Module (if equipped)	No	Yes	—
ACM	No	Yes	—
Driver Climate Control Seat Module	No	Yes	—
DDM	No	Yes	• Autolocks • Easy Entry/Exit • Horn Chirp • Two-Stage Locking
DATC	No	Yes	• Moisture Purge
Electronic Parking Brake	No	Yes	—
FEM	No	Yes	—
Instrument Cluster	No	Yes	• Beltminder • Headlamps On With Wipers • Language
Message Center	No	Yes	—
Navigation System Module	No	Yes	—
Passenger Climate Control Seat Module	No	Yes	—
PCM	Yes	Yes	• Axle Ratio • Fuel Octane • Tire/Wheel Size

			• Transmission Type
REM	No	Yes	—

Programmable Module Installation

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

Using the Vehicle Communication Module (VCM) When the Original Module is Not Available

1. Install the new module.
2. Using the VCM and the latest version of the service function card, SELECT: Programmable Module Installation.
3. Select the module being installed.
4. Follow the on-screen instructions.
5. SELECT: Retrieve Module Configuration — Old ECU and press trigger.
6. Follow the on-screen instructions.
7. The VCM attempts to retrieve the module data.
   - If the module data is available, go to Step A.
   - If the VCM displays: Call the As-Built Data Center, go to Step B.

Step A

1. SELECT: Restore Configuration — New ECU. Press trigger.
2. The VCM completes loading the retrieved data and displays Module Download Successful.
3. Test the module for correct operation.

Step B

1. Press the trigger.
2. If the VCM asks for vehicle data, enter the vehicle data, then press store.
3. The VCM asks for module data line 1. Enter the data and press store.
4. The VCM then asks if there is an additional line of data available for that address. Select YES or NO depending on the information in the As Built Data Sheet.

5. Repeat Steps 3 and 4 until the answer is NO for Step 4.
6. The VCM should show a screen stating that the module data was stored. Press the trigger.
7. Follow the on-screen instructions.
8. SELECT: Restore Configuration — New ECU. Press the trigger.
9. The VCM completes loading the retrieved data and displays Module Download Successful.
10. Test the module for correct operation.

Using the Vehicle Communication Module (VCM) When the Original Module is Available

1. With the original module still installed, using the VCM and the latest version of the service function card, SELECT: Programmable Module Installation.
2. Select the module being installed and press the trigger.
3. Follow the on-screen instructions.
4. SELECT: Retrieve Module Configuration — Old ECU. Press the trigger.
5. Follow the on-screen instructions.
6. INSTALL new module, SELECT: Restore Configuration — New ECU. Press the trigger.
7. The VCM completes loading the retrieved data and displays Module Download Successful.
8. Test the module for correct operation.

Using the Worldwide Diagnostic System (WDS) When the Original Module is Not Available

1. Install the new module.
2. Connect the WDS and ID the vehicle as normal.
3. From the Toolbox icon, select and highlight Module Programming. Then highlight the module that was installed and press the check mark.
4. Select and highlight Programmable Module Installation. Then highlight the module that was installed and press the check mark.
5. Follow the on-screen instructions, turn the ignition key to the RUN position and press the check mark.
6. The WDS retrieves the module data, automatically downloads the data into the new module, and displays Module Configuration Complete.
7. If the data is not available in the module, the WDS displays a screen stating to contact the As-Built Data Center. Retrieve the data from WWW.FMCDEALER.COM at this time and press the check mark.

8. Enter the module data (the module address and line are displayed to the left of the 3 entry boxes) and press the check mark.
9. The WDS downloads the data into the new module and displays Operation Successful — Programming Complete.
10. Test the module for correct operation.

Using the Worldwide Diagnostic System (WDS) When the Original Module is Available

1. Connect the WDS and ID the vehicle as normal.
2. From the Toolbox icon, select and highlight Module Programming and press the check mark.
3. Select and highlight Programmable Module Installation.
4. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark.
5. Install the new module and press the check mark.
6. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark.
7. The module configuration is complete.
8. Test the module for correct operation.

Anti-Theft — Perimeter

The anti-theft perimeter protection feature is controlled by the front electronic module (FEM), the rear electronic module (REM), and the driver door module (DDM). The alarm can be armed using:

- the LOCK button in the remote keyless entry (RKE) transmitter to the DDM, which sends a message through the standard corporate protocol (SCP) communications network to the FEM.
- the driver or passenger door lock switch if the corresponding door is open when LOCK is actuated.
- the key in the driver door lock cylinder.
- the RKE keypad by pressing 7/8 and 9/0 simultaneously.

The FEM and REM then monitor all features, which activate the alarm in the event of an unauthorized entry.

The luggage compartment lid lock cylinder does not disarm the vehicle's perimeter alarm. The luggage compartment alarm can be temporarily inhibited through the luggage compartment lid disarm switch, located in the luggage compartment lock cylinder or by opening the lugguage compartment with the RKE transmitter or the RKE keypad. Once the luggage compartment lid closes, the perimeter alarm system immediately starts monitoring the luggage compartment. The perimeter alarm can only be disarmed:

- by unlocking the vehicle using the RKE transmitter.
- by unlocking the vehicle using the driver door lock cylinder switch.
- by cycling to RUN a valid programmed key in the ignition switch.
- by entering the correct vehicle unlock code on the RKE keypad.

Additionally, an ignition switch tamper circuit and a signal hardwire line from the FEM to the REM are monitored.

If any of the above features receive any activation once the alarm is armed, the alarm activates the visual and audible alerts.

Anti-Theft — Perimeter

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Anti-theft hood switch • Driver door arm/disarm switch • Luggage compartment lid disarm switch • Ignition switch • Vehicle horn • Door ajar switches • Luggage compartment lid ajar switch	• Central junction box (CJB) fuse 5 (5A) • Battery junction box (BJB) fuse(s): ♦ 22 (20A) ♦ 25 (40A) • FEM • REM • DDM • Connectors • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
    - check that the program card is correctly installed.
    - check the connections to the vehicle.
    - check the key switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
    - SCP, ISO, UBP or CAN circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
    - No response/not equipped for FEM, refer to Section 419-10 .
    - No response/not equipped for REM, refer to Section 419-10 .
    - No response/not equipped for DDM, refer to Section 419-10 .
    - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM, REM and DDM.

7. If the DTCs retrieved are related to the concern, go to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index, the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index, or the Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index to continue diagnostics.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	FEM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 . REPEAT the self-test.
B1519	Hood Switch Circuit Failure	FEM	GO to Pinpoint Test A .
B1676	Battery Voltage Out of Range	FEM	GO to Pinpoint Test D .
All other DTCs	—	FEM	REFER to Section 419-10 .

Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	REM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved again, INSTALL a new REM. REFER to Section 419-10 . REPEAT the self-test.

B1676	Battery Voltage Out of Range	REM	GO to Pinpoint Test E .
B1984	Luggage Compartment Lid Anti-theft Disarm Circuit Short to Ground	REM	GO to Pinpoint Test H .
All other DTCs	—	REM	REFER to Section 419-10 .

Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	DDM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved again, INSTALL a new DDM. REFER to Section 419-10 . REPEAT the self-test.
B1676	Battery Voltage Out of Range	DDM	GO to Pinpoint Test F .
B2112	Door Driver Set Switch Stuck Failure	DDM	GO to Pinpoint Test B .
B2116	Door Driver Reset Switch Stuck Failure	DDM	GO to Pinpoint Test B .
All other DTCs	—	DDM	REFER to Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Anti-Theft System Does Not Operate Correctly — Lights Flash 5 Times When Arming The System

Normal Operation

The ajar switches are monitored by the rear electronic module (REM) and front electronic module (FEM). The REM communicates with the FEM on circuit 91S-GL13 (BN). When an arm request is received by the FEM, the switch positions are queried, and if any door, hood, or luggage compartment lid is ajar, then lights flash 5 times.

If the doors are locked with the remote keyless entry (RKE) transmitter and the lock button is pressed a second time, the horn chirps twice to indicate that a door, decklid or hood is ajar. The anti-theft hood switch is deactivated when circuit 8-GL7 (WH) is grounded through circuit 31-GL7 (BK/YE).

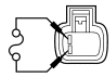
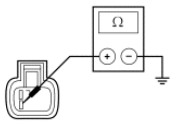
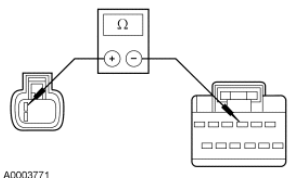
Possible Causes

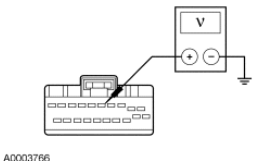
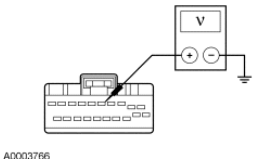
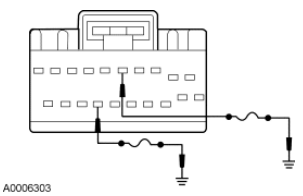
- circuit 8-GL7 (WH) open or short to ground
- circuit 31-GL7 (BK/YE) open or short to voltage
- circuit 91S-GL13 (BN) open or short to voltage
- anti-theft hood switch
- luggage compartment lid ajar switch
- door ajar switch(es)
- FEM
- REM

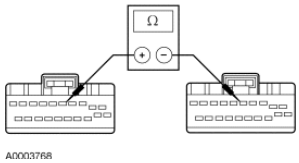
PINPOINT TEST A: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — LIGHTS FLASH 5 TIMES WHEN ARMING THE SYSTEM

⚠ **CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connectors.**

Test Step	Result / Action to Take
A1 RETRIEVE THE RECORDED FEM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded FEM DTCs from the continuous and on-demand self-tests. • **Are any FEM DTCs recorded?**	**Yes** If DTC B1519, GO to A5 . For all other FEM DTCs, REFER to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index. **No** GO to A2 .
A2 RETRIEVE THE RECORDED REM DTCS FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded REM DTCs from the continuous and on-demand self-tests. • **Are any REM DTCs recorded?**	**Yes** REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index. **No** GO to A3 .
A3 RETRIEVE THE RECORDED DRIVER DOOR MODULE (DDM) DTCS FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded DDM DTCs from the continuous and on-demand self-tests. • **Are any DDM DTCs recorded?**	**Yes** REFER to the Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index. **No** GO to A4 .
A4 CHECK THE INTERIOR COURTESY LAMP OPERATION	

• Open and close each door, while observing the interior courtesy lamps. • Open and close the luggage compartment lid, while observing the luggage compartment lamp. • **Do the courtesy lamps operate correctly?**	**Yes** GO to A5 . **No** REFER to Section 417-02 to continue diagnosis of the courtesy lamps.
A5 CHECK FOR A FAULTY ANTI-THEFT HOOD SWITCH	
• Ignition ON. • Disconnect: Anti-Theft Hood Switch C127. • Monitor the FEM PID HOOD_SW, while connecting a fused (5A) jumper wire between the anti-theft hood switch C127-1, circuit 8-GL7 (WH), harness side and the anti-theft hood switch C127-2, circuit 31-GL7 (BK/YE), harness side.  A0003769 • **Does the FEM PID HOOD_SW change from ajar to closed?**	**Yes** INSTALL a new the anti-theft hood switch. CLEAR the DTCs. REPEAT the self-test. **No** GO to A6 .
A6 CHECK CIRCUIT 31-GL7 (BK/YE) FOR AN OPEN	
• Measure the resistance between the anti-theft hood switch C127-2, circuit 31-GL7 (BK/YE), harness side and ground.  A0003770 • **Is the resistance less than 5 ohms?**	**Yes** GO to A7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A7 CHECK CIRCUIT 8-GL7 (WH) FOR AN OPEN	
• Disconnect: FEM C201c. • Measure the resistance between the anti-theft hood switch C127-1, circuit 8-GL7 (WH), harness side and the FEM C201c-3, circuit 8-GL7 (WH), harness side.  A0003771 • **Is the resistance less than 5 ohms?**	**Yes** GO to A8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

A8 CHECK CIRCUIT 91S-GL13 (BN) FOR A SHORT TO BATTERY	
• Disconnect: FEM C201f. • Measure the voltage between the FEM C201f-5, circuit 91S-GL13 (BN), harness side and ground.  A0003766 • **Is the voltage greater than 10 volts?**	**Yes** GO to A9 . **No** GO to A10 .
A9 CHECK THE REM FOR AN INTERNAL SHORT TO BATTERY	
• Ignition OFF. • Disconnect: REM C420d. • Ignition ON. • Measure the voltage between the FEM C201f-5, circuit 91S-GL13 (BN), harness side and ground.  A0003766 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
A10 CHECK THE REM OPERATION	
• Ignition OFF. • Disconnect: REM C420d. • Using a fused (5A) jumper wire, jumper REM C420d-5, circuit 91S-GL13 (BN), harness side to ground. Using a second fused (5A) jumper wire, jumper REM C420d-17, circuit 31S-GL19 (BK/GN), harness side to ground.  A0006303 • Close all doors, the hood, and the luggage compartment lid. • Arm the anti-theft system. • **Do the lights flash 5 times when the system is armed?**	**Yes** REMOVE the jumper wires. GO to A11 . **No** INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
A11 CHECK CIRCUIT 91S-GL13 (BN) FOR AN OPEN	

• Measure the resistance between the FEM C201f-5, circuit 91S-GL13 (BN), harness side and the REM C420d-5, circuit 91S-GL13 (BN), harness side.  A0003768 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Alarm System Does Not Arm/Disarm — Using The Driver Door Arm/Disarm Switch

Normal Operation

The driver door arm/disarm switch grounds either circuit 31S-AA78 (BK/BU) or 31S-AA79 (BK/WH) to the driver door module (DDM). The DDM then communicates over the standard corporate protocol (SCP) communication network to the front electronic module (FEM) to arm/disarm the alarm system.

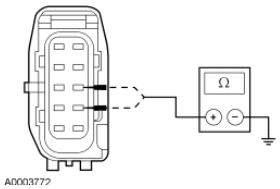
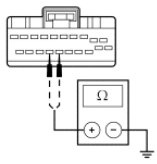
Possible Causes

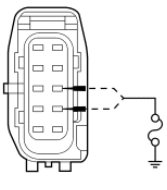
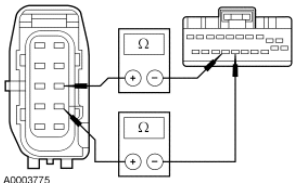
- circuit 31S-AA78 (BK/BU) open or short to ground
- circuit 31S-AA79 (BK/WH) open or short to ground
- driver door arm/disarm switch
- DDM

PINPOINT TEST B: THE ALARM SYSTEM DOES NOT ARM/DISARM — USING THE DRIVER DOOR ARM/DISARM SWITCH

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connectors.

Test Step	Result / Action to Take
B1 RETRIEVE THE RECORDED DDM DTCS FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded DDM DTCs from the continuous and on-demand self-tests. • **Are any DDM DTCs recorded?**	**Yes** If DTC B2112 or B2116, GO to B3 . **No** GO to B2 .
B2 CHECK THAT THE DRIVER DOOR LOCK AND UNLOCK PIDS READ CORRECTLY	
• Monitor the DDM PIDs D_DSRM and DRLKCYL while turning the key in the driver door lock cylinder to the LOCK and UNLOCK positions. • **Do the DDM PID values agree with the LOCK positions?**	**Yes** INSTALL a new DDM. REFER to Section 419-10 . PROGRAM the RKE transmitters. REFER to Section 501-14 . CLEAR the

	DTCs. REPEAT the self-test. **No** GO to B5 .
B3 CHECK CIRCUITS 31S-AA78 (BK/BU) AND 31S-AA79 (BK/WH) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Driver Door Lock Unit C525. • Measure the resistance between the driver door lock unit C525-5, circuit 31S-AA79 (BK/WH), harness side and ground; and between the driver door lock unit C525-7, circuit 31S-AA78 (BK/BU), harness side and ground.  A0003772 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver door latch. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test. **No** GO to B4 .
B4 CHECK THE DDM FOR AN INTERNAL SHORT TO GROUND	
• Disconnect: DDM C501c. • Measure the resistance between the DDM C501c-16, circuit 31S-AA78 (BK/BU), harness side and ground; and between the DDM C501c-17, circuit 31S-AA79 (BK/WH), harness side and ground.  A0003773 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new DDM. REFER to Section 419-10 . PROGRAM the RKE transmitters. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
B5 CHECK THE DRIVER SET AND DRIVER RESET SWITCH	
• Disconnect: Driver Door Lock Unit C525. • Monitor the DDM PIDs D_DSRM and DRLKCYL while connecting a fused (5A) jumper wire between the driver door lock unit C525-5, circuit 31S-AA79 (BK/WH), harness side and ground; and between the driver door lock unit C525-7, circuit 31S-AA78 (BK/BU), harness side and ground.	**Yes** INSTALL a new driver door latch. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test. **No** GO to B6 .

 A0003774 • **Do the DDM PID values agree with the LOCK positions?**	
B6 CHECK CIRCUITS 31S-AA78 (BK/BU) AND 31S-AA79 (BK/WH) FOR AN OPEN	
• Disconnect: DDM C501c. • Measure the resistance between the DDM C501c-16, circuit 31S-AA78 (BK/BU), harness side and the driver door lock unit C525-7, circuit 31S-AA78 (BK/BU), harness side: and the DDM C501c-17, circuit 31S-AA79 (BK/WH), harness side and the driver door lock unit C525-5, circuit 31S-AA79 (BK/WH), harness side.  A0003775 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DDM. REFER to Section 419-10 . PROGRAM the RKE transmitters. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The Alarm System Does Not Arm/Disarm — Using The Remote Keyless Entry Transmitter

Normal Operation

The remote keyless entry (RKE) transmitter triggers the driver door module (DDM) to arm/disarm the alarm system.

Possible Causes
- RKE transmitter
- DDM

PINPOINT TEST C: THE ALARM SYSTEM DOES NOT ARM/DISARM — USING THE REMOTE KEYLESS ENTRY TRANSMITTER

Test Step	Result / Action to Take
C1 CHECK THE ALARM SYSTEM USING THE DRIVER DOOR ARM/DISARM SWITCH	
• Arm and disarm the alarm system using the driver door arm/disarm switch. • **Does the alarm system set and reset correctly?**	**Yes** REFER to Section 501-14 to continue diagnosis of the RKE transmitter. **No** GO to Pinpoint Test B .

Pinpoint Test D: Battery Voltage Out Of Range — Front Electronic Module (FEM)

Normal Operation

The FEM arms/disarms the alarm system. The FEM receives voltage over circuits 29-DK22 (OG/YE) and 29-DK20 (OG/GN), 29S-DK21 (OG/WH).

Possible Causes

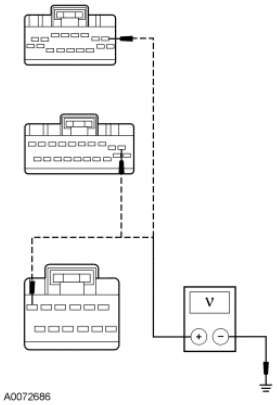
- circuit 29-DK20 (OG/GN) open or short to ground
- circuit 29S-DK21 (OG/WH) open or short to ground
- circuit 29-DK22 (OG/YE) open or short to ground
- FEM

PINPOINT TEST D: BATTERY VOLTAGE OUT OF RANGE — FRONT ELECTRONIC MODULE (FEM)

⚠ **CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connectors.**

Test Step	Result / Action to Take
D1 RETRIEVE THE RECORDED FEM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded FEM DTCs from the continuous and on-demand self-tests. • **Are any FEM DTCs recorded?**	**Yes** If DTC B1676, GO to D2 . **No** GO to D3 .
D2 CHECK THE BATTERY VOLTAGE PID	
NOTE: Turn the ignition switch from OFF to ON to enable the switched system power feature. • Ignition ON. • Monitor the FEM PID VBAT. • **Is the voltage between 9 and 16 volts?**	**Yes** RUN the self-test. If DTC B1676 is still present, INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No** GO to D3 .
D3 CHECK THE VOLTAGE SUPPLY TO THE MODULE	
• Ignition OFF. • Disconnect: FEM C201f. • Disconnect: FEM C201c. • Disconnect: FEM C201a. • Ignition ON. • Using the following table, measure the voltage between FEM connectors, harness side and ground:	**Yes** INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No** REFER to Section 414-00 to continue battery system diagnosis.

FEM Connector-Pin	Circuit
C201f-1	29S-DK22 (OG/YE)
C201c-6	29-DK20 (OG/GN)
C201a-1	29S-DK21 (OG/WH)



- **Are the voltages between 9 and 16 volts?**

Pinpoint Test E: Battery Voltage Out Of Range — Rear Electronic Module (REM)

Normal Operation

The REM monitors the rear door ajar and luggage compartment lid ajar switch and transmits the ajar status to the front electronic module (FEM) through the communication network. The REM receives voltage over circuits 29-DK31 (OG/BK), 29S-DK31 (OG/BK), 30-DK30A (BK) and 30-DK30 (RD).

Possible Causes

- circuit 29-DK31 (OG/BK) open or short to ground
- circuit 29S-DK31 (OG/BK) open or short to ground
- circuit 30-DK30 (RD) open or short to ground
- circuit 30-DK30A (BK) open or short to ground
- REM

PINPOINT TEST E: BATTERY VOLTAGE OUT OF RANGE — REAR ELECTRONIC MODULE (REM)

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connectors.

Test Step	Result / Action to Take
E1 RETRIEVE THE RECORDED REM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded REM DTCs from the continuous	**Yes** If DTC B1676, GO to E2 .

and on-demand self-tests. • **Are any DTCs recorded?**	**No** GO to E3 .
E2 CHECK THE BATTERY VOLTAGE PID	
NOTE: Turn the ignition switch from OFF to ON to enable the switched system power feature. • Ignition ON. • Monitor the REM PID VBAT. • **Is the voltage between 9 and 16 volts?**	**Yes** RUN the self-test. If DTC B1676 is still present, INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No** GO to E3 .
E3 CHECK THE VOLTAGE SUPPLY TO THE MODULE	
• Ignition OFF. • Disconnect: REM C420d. • Disconnect: REM C420c. • Disconnect: REM C420f. • Disconnect: REM C420g. • Ignition ON. • Using the following table, measure the voltage between the REM connectors, harness side and ground: • **Are the voltages between 9 and 16 volts?**	**Yes** INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No** REFER to Section 414-00 to continue battery system diagnosis.

REM Connector-Pin	Circuit
C420d-3	29-DK31 (OG/BK)
C420c-13	29S-DK31 (OG/BK)
C420f-4	30-DK30A (RD/OG)
C420g-4	30-DK30 (RD/OG)

Pinpoint Test F: Battery Voltage Out Of Range — Driver Door Module (DDM)

Normal Operation

The DDM transmits an arm/disarm signal through the communication network to the front electronic module (FEM). The DDM receives voltage on circuits 29-AJ80 (OG) and 29S-AJ86 (OG/BU)

Possible Causes
- circuit 29-AJ80 (OG) open or short to ground
- circuit 29S-AJ86 (OG/BU) open or short to ground
- DDM

PINPOINT TEST F: BATTERY VOLTAGE OUT OF RANGE — DRIVER DOOR MODULE (DDM)

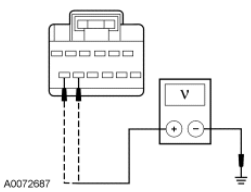
⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe adaptor(s) may damage the connectors.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>F1 RETRIEVE THE RECORDED DDM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS</td><td></td></tr>
<tr><td>• Retrieve the recorded DDM DTCs from the continuous and on-demand self-tests.
• Are any DTCs recorded?</td><td>Yes
If DTC B1676, GO to F2 .

No
GO to F3 .</td></tr>
<tr><td>F2 CHECK THE BATTERY VOLTAGE PID</td><td></td></tr>
<tr><td>NOTE: Turn the ignition switch from OFF to ON to enable the switched system power feature.

• Ignition ON.
• Monitor the DDM PID VBAT.
• Is the voltage between 9 and 16 volts?</td><td>Yes
RUN the self-test. If DTC B1676 is still present, INSTALL a new DDM. REFER to Section 419-10 . PROGRAM the RKE transmitters. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test.

No
GO to F3 .</td></tr>
<tr><td>F3 CHECK VOLTAGE SUPPLY TO THE MODULE</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: DDM C501a.
• Ignition ON.
• Using the following table, measure the voltage between the DDM connector, harness side and ground:

<table><tr><th>DDM Connector-Pin</th><th>Circuit</th></tr><tr><td>C501a-11</td><td>29-AJ80 (OG)</td></tr><tr><td>C501a-12</td><td>29S-AJ86 (OG/BU)</td></tr></table>
 

• Are the voltages between 9 and 16 volts?</td><td>Yes
INSTALL a new DDM. REFER to Section 419-10 . PROGRAM the RKE transmitters. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test.

No
REFER to Section 414-00 to continue battery system diagnosis.</td></tr>
</table>

Pinpoint Test G: The Alarm System Does Not Operate Correctly — Alarm Does Not Activate With Hood Ajar/Open

Normal Operation

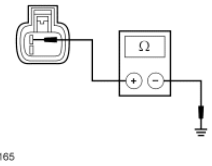
The front electronic module (FEM) monitors the anti-theft hood switch to indicate an open hood on circuit 8-GL7 (WH). The alarm does not activate if the switch is closed and the circuit is grounded.

Possible Causes

- circuit 8-GL7 (WH) open
- anti-theft hood switch
- FEM

PINPOINT TEST G: THE ALARM SYSTEM DOES NOT OPERATE CORRECTLY — ALARM DOES NOT ACTIVATE WITH HOOD AJAR/OPEN

Test Step	Result / Action to Take
G1 RETRIEVE THE RECORDED FEM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded FEM DTCs from the continuous and on-demand self-tests. • **Are any FEM DTCs recorded?**	**Yes** If DTC B1519, GO to Pinpoint Test A . For all other FEM DTCs, REFER to the Front Electronic Module (FEM) Diagnostic Trouble Code (DTC) Index. **No** GO to G2 .
G2 RETRIEVE THE RECORDED REAR ELECTRONIC MODULE (REM) DTCS FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded REM DTCs from the continuous and on-demand self-tests. • **Are any REM DTCs recorded?**	**Yes** REFER to the Rear Electronic Module (REM) Diagnostic Trouble Code (DTC) Index. **No** GO to G3 .
G3 RETRIEVE THE RECORDED DRIVER DOOR MODULE (DDM) DTCS FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded DDM DTCs from the continuous and on-demand self-tests. • **Are any DDM DTCs recorded?**	**Yes** REFER to the Driver Door Module (DDM) Diagnostic Trouble Code (DTC) Index. **No** GO to G4 .

G4 CHECK ANTI-THEFT HOOD SWITCH OPERATION	
• Ignition ON. • Close the hood. • Monitor the FEM PID HOOD_SW while opening the hood. • **Does the FEM PID HOOD_SW change from closed to ajar?**	**Yes** CHECK for a sticking anti-theft hood switch. TEST the system for normal operation. **No** GO to G5 .
G5 CHECK FOR A FAULTY ANTI-THEFT HOOD SWITCH	
• Monitor the FEM PID HOOD_SW. • Disconnect: Anti-Theft Hood Switch C127. • **Does the FEM PID HOOD_SW change when the anti-theft hood switch is disconnected?**	**Yes** INSTALL a new anti-theft hood switch. CLEAR the DTCs. REPEAT the self-test. **No** GO to G6 .
G6 CHECK CIRCUIT 8-GL7 (WH) FOR AN OPEN	
• Disconnect: FEM C201c. • Measure the resistance between the anti-theft hood switch C127-1, circuit 8-GL7 (WH), harness side and ground.  A0063165 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new FEM. REFER to Section 419-10 . TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: The Alarm System Does Not Operate Correctly — Luggage Compartment Lid Disarm Switch

Normal Operation

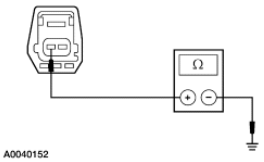
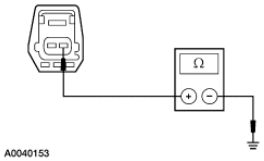
The alarm system can be suspended for the luggage compartment lid by using the luggage compartment lid disarm switch. The switch position is monitored by the rear electronic module (REM). The luggage compartment lid disarm switch is deactivated when circuit 8-GL27 (WH/BU) is grounded through circuit 31-GL27 (BK/OG).

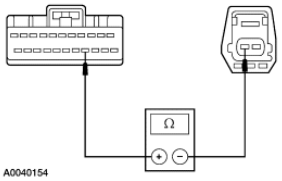
Possible Causes

- circuit 8-GL27 (WH/BU) open or short to ground
- circuit 31-GL27 (BK/OG) open
- luggage compartment lid disarm switch
- REM

PINPOINT TEST H: THE ALARM SYSTEM DOES NOT OPERATE CORRECTLY — LUGGAGE COMPARTMENT LID DISARM SWITCH

NOTE: The luggage compartment lock cylinder will not disarm the perimeter alarm system. Once armed, the perimeter alarm can only be disarmed using the remote keyless entry (RKE) transmitter, driver door arm/disarm switch, the RKE keypad or a valid passive anti-theft system (PATS) key inserted into the ignition lock cylinder and turned to RUN.

Test Step	Result / Action to Take
H1 RETRIEVE THE RECORDED REM DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Retrieve the recorded REM DTCs from the continuous and on-demand self-tests. • **Are there any DTCs recorded?**	**Yes** If DTC B1984, GO to H2 . **No** GO to H3 .
H2 CHECK CIRCUIT 8-GL27 (WH/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Luggage Compartment Lid Disarm Switch C483. • Disconnect: REM C420b. • Measure the resistance between the luggage compartment lid disarm switch C483-2, circuit 8-GL27 (WH/BU), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new luggage compartment lid disarm switch. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
H3 CHECK CIRCUIT 31-GL27 (BK/OG) FOR AN OPEN	
• Ignition OFF. • Disconnect: Luggage Compartment Lid Disarm Switch C483. • Measure the resistance between the luggage compartment lid disarm switch C483-1, circuit 31-GL27 (BK/OG), harness side and ground.  	**Yes** GO to H4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

• **Is the resistance less than 5 ohms?**	
H4 CHECK CIRCUIT 8-GL27 (WH/BU) FOR AN OPEN	
• Disconnect: REM C420b. • Measure the resistance between the REM C420b-15, circuit 8-GL27 (WH/BU), harness side and the luggage compartment lid disarm switch C483-2, circuit 8-GL27 (WH/BU), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new luggage compartment lid disarm switch. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Anti-Theft — Passive Anti-Theft System (PATS)

NOTE: If either the instrument cluster or the PCM are installed, both modules require a parameter reset. Failure to carry out the parameter reset to both the instrument cluster and PCM may result in a no-start condition.

The PATS uses radio frequency identification technology to deter a driveaway theft. Passive means that it does not require any action from the user to make it functional.

PATS uses a specially encoded ignition key. Each PATS key contains a permanently installed electronic device called a transponder. Each transponder contains a unique electronic identification code, with over 72 million billion combinations.

Each PATS key must be programmed into the vehicle PATS module before it can be used to start the engine. There are special diagnostic procedures described in the workshop manual that must be carried out if new PATS keys are to be installed. Refer to General Procedures in this section.

The PATS key is larger than a traditional ignition key. The PATS key does not require batteries and should last the life of the vehicle.

The transceiver module communicates with the PATS key. This module is located in the instrument panel attached to the ignition lock cylinder housing. During each vehicle start sequence, the transceiver module reads the PATS key identification code and sends the data to the instrument cluster. The instrument cluster validates the code as correct and sends the powertrain control module (PCM) an enable code through the network.

The control function is contained in the instrument cluster. This module carries out all of the PATS functions, such as receiving the identification code from the PATS key and controlling the starter enable signal, and communicates with the PCM to enable the engine. The instrument cluster initiates the key interrogation sequence when the PATS key is inserted in the ignition switch and also when the switch is turned to RUN or START.

The PATS module uses the instrument cluster to enable or disable the engine. All elements of PATS must be functional before the engine is allowed to start. If any of the components are not working correctly, the vehicle does not start.

PATS uses a visual anti-theft indicator. This indicator proves out for 3 seconds when the ignition switch is turned to RUN or START under normal operation. If there is a PATS concern, this anti-theft indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the ignition switch is turned to RUN or START.

PATS is active only for a few seconds when the vehicle is starting. It is not a PATS concern if the vehicle stalls after it has been running for a minimum of 3 seconds. PATS will not disable a running vehicle.

PATS may cause a vehicle no start due to either the fuel injectors or the starter not operating (starter relay does not close) or both. Always check for PATS DTCs from the instrument cluster and the PCM when a no-crank or no-start condition exists. A low state of charge (SOC) in the vehicle battery may cause the PATS to allow the starter operation, but prevent the fuel injectors from operating.

If the theft light does not prove out (it may be either flashing or glowing steadily) and one (or both) of the previous conditions (fuel injectors and/or starter inoperative) are present, it may be due to a PATS issue. If the theft light proves out, it may not be a PATS issue. If the theft light does not illuminate at all, it may be a circuitry/light sensor issue. Refer to Symptom Chart in this section.

PATS is not compatible with aftermarket remote start systems, which allow the vehicle to be started from outside the vehicle. These systems may reduce the vehicle security level, and also may cause no-start issues. Remote start systems must be removed before investigation of PATS-related no-start issues.

Anti-Theft — Passive Anti-Theft System (PATS)

Refer to Wiring Diagrams Cell 112 for schematic and connector information.

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Passive Anti-Theft System (PATS) — Principles of Operation

NOTE: The new instrument cluster must be reconfigured after installation. Refer to Section 418-01 .

PATS is active only for a few seconds when the vehicle is starting. It is not a PATS concern if the vehicle stalls after it has been running for a minimum of 3 seconds. PATS will not disable a running vehicle.

PATS may cause a vehicle no start due to either the fuel injectors or the starter not operating (starter relay does not close) or both. Always check for PATS DTCs from the instrument cluster and the PCM when a no-crank or no-start condition exists. A low state of charge (SOC) in the vehicle battery may cause the PATS to allow the starter operation, but prevent the fuel injectors from operating.

If the theft light does not prove out (it may be either flashing or glowing steadily) and one (or both) of the previous conditions (fuel injectors and/or starter inoperative) are present, it may be due to a PATS issue. If the theft light proves out, it may not be a PATS issue. If the theft light does not illuminate at all, it may be a circuitry/light sensor issue. GO to Symptom Chart in this section.

Passive Anti-Theft System (PATS) — Inspection and Verification

NOTE: The new instrument cluster must be reconfigured after installation. Refer to Section 418-01 .

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Large metallic objects, a second passive anti-theft system (PATS) key on the same key ring as the PATS key, or electronic devices on the key chain that can be used to purchase gasoline or similar items • ignition lock cylinder • PATS key • Use of a non-PATS key • More than one PATS key on the customer's key chain	• Central junction box (CJB) fuse(s): ♦ 2 (10A) ♦ 7 (5A) • Instrument cluster • PATS transceiver module • Ignition switch • Loose or corroded connection(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
   - check that the program card is correctly installed.
   - check the connections to the vehicle.
   - check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:

- ISO, SCP or UBP circuit fault; all electronic control units no response/not equipped, refer to Section 418-00 .
- No response/not equipped for instrument cluster, refer to Section 413-01 .
- No response/not equipped for powertrain control module (PCM), refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
- System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out the self-test diagnostics for the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Passive Anti-Theft System (PATS) — Diagnostic Trouble Codes (DTC) Index .

8. If no DTCs related to the concern are retrieved, go to the Passive Anti-Theft System (PATS) — Symptom Chart .

Passive Anti-Theft System (PATS) — Diagnostic Trouble Codes (DTC) Index

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	Instrument Cluster	GO to Pinpoint Test C .
B1342	ECU is Faulted	Instrument Cluster	CLEAR the DTCs. CARRY OUT the instrument cluster self-test. If DTC B1342 is retrieved, INSTALL a new instrument cluster. REFER to Section 413-01 .
B1600	PATS Ignition Key Transponder Signal is Not Received	Instrument Cluster	GO to Pinpoint Test F .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	Instrument Cluster	GO to Pinpoint Test G .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	Instrument Cluster	GO to Pinpoint Test H .
B1681	PATS Transceiver Module Signal is Not Received	Instrument Cluster	GO to Pinpoint Test I .
B2103	Antenna Not Connected	Instrument Cluster	GO to Pinpoint Test J .
B2139	Data Mismatch	Instrument Cluster	GO to Pinpoint Test D .
B2141	NVM Configuration Failure	Instrument Cluster	GO to Pinpoint Test E .
B2431	Transponder Programming Failed	Instrument Cluster	GO to Pinpoint Test F .
B2477	Module Configuration Failure	Instrument Cluster	REFER to Section 418-01 .
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security	Instrument Cluster/Powertrain Control Module (PCM)	GO to Pinpoint Test D .
U1262	SCP Communications BUS Fault	Instrument Cluster/PCM	REFER to Section 418-00 .

Passive Anti-Theft System (PATS) — Diagnostic Trouble Codes (DTC) Descriptions

Expanded Diagnostic Trouble Code (DTC) Descriptions

DTC	Expanded Description
B1213	Less than 2 keys programmed to the PATS control. Use the diagnostic card to run the self-test on the PATS functions in the instrument cluster. If DTC B1232, B1600, B1601, B1602 or B1681 are present, they must be serviced first. If DTC B1213 is the only self-test DTC, then program the PATS keys.
B1232	Transceiver module antenna failure.
B1600	No PATS key read by the PATS control. This can be caused by the PATS key, PATS transceiver, circuits between the PATS transceiver and the PATS control and/or the PATS control.
B1601	Unprogrammed PATS key. There is no issue with the PATS key itself, but the key must be programmed into the PATS memory (unless the maximum number of keys are already programmed). Refer to Spare Key Programming in this section. No parts need to be replaced for this DTC.
B1602	Partial PATS key was read. Make sure that approved PATS key (Ford, Rotunda, Huf Â or Strattec) is being used. Large metal objects, additional PATS keys, or devices used to purchase gasoline located on the customer's key ring can cause interference. Instruct the customer to keep such items from touching the ignition key during engine start. It is not necessary to remove the objects from the customer's key ring. Remote starter equipment can also cause this DTC. Remove any remote starter equipment close to the transceiver before conducting further diagnosis. This DTC can be caused by the PATS key or the PATS transceiver.
B1681	PATS transceiver module signal is not received by the PATS control. This DTC can be caused by circuits between the PATS transceiver and the PATS control, the PATS transceiver or the PATS control. Follow the pinpoint test for diagnosis. This can also be caused by using the incorrect transceiver part number. Make sure that the correct transceiver part number is being used.
B2103	Transceiver module antenna failure. Incorrect or nonexistent diagnostic data from the transceiver.
B2139	The PCM_ID does not match between the PCM and the PATS instrument cluster.
B2141	NVM configuration failure. PATS does not have a stored PCM_ID in memory (PATS PID PCM_ID=not STORED). If a DTC U1147 is also present, it must be repaired first. If a DTC U1262 is also present, attempt to repair the DTC. However, repair to DTC U1262 may not be required prior to repairing DTC B2141.
B2431	The ignition key (Lincoln LS only) was not programmed. This vehicle uses a special ignition key. Program a new ignition key, using the correct style key.
P1260	This DTC is stored any time the PCM disables the vehicle because of a PATS issue. Whenever the PCM stores DTC P1260, there should be a PATS DTC(s) stored in the instrument cluster that requires diagnosis.
U1147	Indicates a communication issue between the PCM and PATS instrument cluster. This DTC cannot be caused by the PATS key, the PATS transceiver or the circuits between the PATS transceiver and PATS control. Whenever PATS has the DTC U1147 stored, there should be a DTC P1260, Theft Detected-Engine Disabled, stored in the PCM. Verify that DTC P1260 is stored in the PCM. If the DTC P1260 is not stored in the PCM, there is a power up issue for the PCM. (For example: PATS is powering up at key ON/START, but the PCM is not. Therefore, PATS tries to communicate over circuits 914 and 915 and there is no response from the PCM.) Make sure the PCM power and ground circuits are functioning. Make sure the diagnostic tool can communicate with the PCM.
U1262	

	Indicates a communication issue between the PATS control instrument cluster and some other module. Do not carry out the PATS diagnostics if a no start is not reported or if the anti-theft indicator is not flashing rapidly at key ON. If the indicator is flashing, check to make sure the PCM is powered up and operating. If the PCM is not powered up or operating, continue with PCM diagnostics.

Passive Anti-Theft System (PATS) — Symptom Chart

Symptom Chart

Passive Anti-Theft System (PATS) — Pinpoint Tests

Pinpoint Tests

Pinpoint Test A: The Anti-Theft Indicator Is Never On — No 3-Second Anti-Theft Indicator Prove-out

Normal Operation

The passive anti-theft system (PATS) uses an anti-theft indicator housed in the light sensor. This indicator proves out for 3 seconds when the ignition switch is turned to the RUN or START position under normal operation. If there is a PATS concern, this indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the ignition switch is turned to the RUN or START position. The anti-theft indicator receives voltage on circuit 10-GL6 (GY/VT) and ground on circuit 29-GL6 (OG).

Possible Causes

- fuse
- circuit 10-GL6 (GY/VT) open or short to ground
- circuit 29-GL6 (OG) open or short to ground
- no signal from the instrument cluster
- light sensor
- instrument cluster

PINPOINT TEST A: THE ANTI-THEFT INDICATOR IS NEVER ON — NO 3-SECOND ANTI-THEFT INDICATOR PROVE-OUT

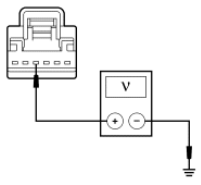
NOTE: Large metallic objects, electronic devices on the key chain that can be used to purchase gasoline or similar items, or a second key on the same key ring as the passive anti-theft system (PATS) key may cause vehicle starting problems and record DTCs under certain conditions. If a fault cannot be identified, examine the customer's key ring for such objects or devices.

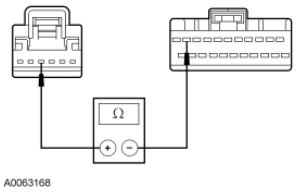
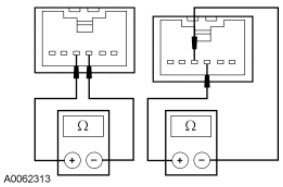
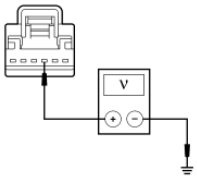
If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary concern if they are too close to the key during engine start.

If a concern occurs, turn the ignition switch OFF and restart the engine with all other objects on the key ring held away from the PATS key.

Check to make sure the key used by the customer is a Ford-approved PATS key. (PATS keys from Rotunda, Huf or Strattec are approved Ford PATS keys.)

Test Step	Result / Action to Take
A1 ENTER THE INSTRUMENT CLUSTER ACTIVE COMMAND MODE	
• Ignition OFF.	**Yes** GO to A2 .

• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Instrument Cluster Active Command. • **Can the instrument cluster active command mode be entered?**	**No** REFER to Section 413-01 to continue communication diagnostics.
A2 CHECK THE ANTI-THEFT INDICATOR — TRIGGER THE INSTRUMENT CLUSTER ACTIVE COMMAND THEFT_LAMP TO ON	
• Trigger the instrument cluster active command THEFT_LAMP to ON. • **Does the anti-theft indicator illuminate?**	**Yes** The anti-theft indicator is OK. VERIFY the concern with the customer. **No** GO to A3 .
A3 CHECK THE INSTRUMENT CLUSTER OUTPUT TO THE ANTI-THEFT INDICATOR FOR VOLTAGE — CIRCUIT 10-GL6 (GY/VT)	
• Ignition OFF. • Disconnect: Light Sensor C286. • Ignition ON. • While triggering the instrument cluster active command THEFT_LAMP to ON, measure the voltage between the light sensor C286-4, circuit 10-GL6 (GY/VT), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to A5 . **No** GO to A4 .
A4 CHECK CIRCUIT 10-GL6 (GY/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: Instrument Cluster C220a. • Measure the resistance between the instrument cluster C220a-10, circuit 10-GL6 (GY/VT), harness side and the light sensor C286-4, circuit 10-GL6 (GY/VT), harness side.	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. TEST the system for normal operation. PROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. **No** VERIFY central junction box (CJB) fuse 7 (5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 A0063168 • **Is the resistance less than 5 ohms?**	
A5 CHECK THE ANTI-THEFT INDICATOR FOR CORRECT OPERATION	
• Measure the resistance between the light sensor C286-4 and the light sensor C286-3 component side.  A0062313 • **Is the resistance greater than 10,000 ohms in 1 direction and 10-20 ohms in the other direction?**	**Yes** GO to A6 . **No** INSTALL a new light sensor. REFER to Section 417-01 . CLEAR the DTCs. REPEAT the self-test.
A6 CHECK THE LIGHT SENSOR CIRCUIT 29-GL6 (OG) FOR VOLTAGE	
• Ignition OFF. • Measure the voltage between the light sensor C286-3, circuit 29-GL6 (OG), harness side and ground.  A0063169 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new light sensor. REFER to Section 417-01 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Anti-Theft System Does Not Operate Correctly — The Vehicle Cranks But The Anti-Theft Indicator Flashes Rapidly At Key On

Normal Operation

The passive anti-theft system (PATS) uses an LED indicator. This indicator proves out for 3 seconds when the ignition switch is turned to RUN or START under normal operation. If there is a PATS concern, this indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the ignition switch is turned to RUN or START.

Possible Causes

- powertrain control module (PCM) calibration

- PCM

PINPOINT TEST B: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — THE VEHICLE CRANKS BUT THE ANTI-THEFT INDICATOR FLASHES RAPIDLY AT KEY ON

Test Step	Result / Action to Take
B1 CHECK THE ANTI-THEFT INDICATOR FOR CORRECT OPERATION	
• Start the engine. • Verify the anti-theft indicator proves out correctly. • **Does the anti-theft indicator flash and/or does the vehicle start?**	**Yes** If the anti-theft indicator flashes and the vehicle starts, VERIFY the correct PCM calibration for the vehicle. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If the anti-theft indicator flashes but the vehicle does not start, refer to the GO to Symptom Chart . **No** The system is OK.

Pinpoint Test C: DTC B1213 — Passive Anti-Theft System (PATS) Number Of Programmed Keys Is Below Minimum

Normal Operation

The passive anti-theft system (PATS) transceiver reads the PATS key code and sends the code to the instrument cluster. The instrument cluster validates the code. The control functions are contained in the instrument cluster. This instrument cluster carries out all of the PATS functions such as receiving the identification code from the PATS key and controlling engine enable. The instrument cluster initiates the key interrogation sequence when the key is inserted in the ignition switch and when the switch is turned to the START or RUN position.

Possible Causes

- less than 2 keys programmed to the system
- unprogrammed PATS key
- PATS transceiver
- instrument cluster

PINPOINT TEST C: DTC B1213 — PASSIVE ANTI-THEFT SYSTEM (PATS) NUMBER OF PROGRAMMED KEYS IS BELOW MINIMUM

Test Step	Result / Action to Take
C1 RETRIEVE THE INSTRUMENT CLUSTER DIAGNOSTIC TROUBLE CODES (DTCS)	
• Ignition OFF. • Connect the scan tool.	**Yes** GO to C2 .

• Ignition ON. • Enter the following diagnostic mode on the scan tool: RETRIEVE DTCs. • Enter the following diagnostic mode on the scan tool: CLEAR DTCs. • Carry out the instrument cluster on-demand self-test. • **Is DTC B1213 the only DTC retrieved?**	**No** REPAIR the other DTCs retrieved. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index. CLEAR the DTCs. REPEAT the self-test.
C2 CHECK FOR PROGRAMMED PATS KEYS	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Monitor the instrument cluster number of keys PID. • **Does the instrument cluster number of keys PID display less than 2 PATS keys programmed?**	**Yes** GO to C3 . **No** The system is OK.
C3 PROGRAM THE PATS KEYS	
• **NOTE:** Two PATS keys must be programmed in order to start the vehicle. • If 2 keys are not available from the customer, cut a new PATS key. • Ignition ON. • Program the new PATS key(s). Refer to Key Programming Using Diagnostic Equipment in this section. • **Does the anti-theft indicator illuminate for 3 seconds and then go out?**	**Yes** CLEAR the DTCs. CARRY OUT the self-test to verify all codes are cleared. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section. **No** RETRIEVE DTC stored for new fault and REPAIR the other DTC(s) retrieved. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

Pinpoint Test D: DTC B2139 and U1147 — Data Mismatch

Normal Operation

The passive anti-theft system (PATS) transceiver reads the PATS key code and sends the code to the instrument cluster. The instrument cluster validates the code. The control functions are contained in the instrument cluster. This instrument cluster carries out all of the PATS functions such as receiving the identification code from the PATS key and controlling engine enable. The instrument cluster initiates the key interrogation sequence when the key is inserted in the ignition switch and when the switch is turned to the START or RUN position.

Possible Causes

- powertrain control module (PCM) calibration
- instrument cluster calibration
- instrument cluster

PINPOINT TEST D: DATA MISMATCH

Test Step	Result / Action to Take
D1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE INSTRUMENT CLUSTER SELF-TEST	
• Retrieve the recorded instrument cluster DTCs. • **Is DTC B2139 or U1147 recorded?**	**Yes** GO to D2 . **No** The system is OK.
D2 CLEAR THE PCM ID FROM INSTRUMENT CLUSTER AND PCM	
• Carry out the security access procedure for the instrument cluster. Refer to Anti-Theft Security Access in this section. • **NOTE:** DO NOT carry out the ignition key code erase. • CARRY OUT parameter reset on the instrument cluster. Select PARAMETER RESET command for the instrument cluster. Refer to Passive Anti-Theft System (PATS) Parameter	**Yes** VERIFY the PCM calibration is correct for the vehicle. If correct, INSTALL a new instrument cluster. REFER to Section 413-01 . TEST the system for normal operation. PROGRAM 2 keys. REFER to Key Programming Using Diagnostic Equipment in this section. CARRY OUT the parameter reset procedure. For additional information, REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. CLEAR the DTCs. REPEAT the self-test. If DTC B2139 or U1147 still exists, INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. If the vehicle is equipped with the valet feature, PROGRAM the third PATS key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section. **No** The system is OK. CHECK for any other DTCs. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

Reset in this section. • Carry out the security access procedure for the PCM. Refer to Anti-Theft Security Access in this section. • **NOTE:** DO NOT carry out the ignition key code erase. • CARRY OUT parameter reset on the PCM. Select PARAMETER RESET command for the PCM. Refer to Passive Anti-Theft System (PATS) Parameter Reset in this section. • Ignition OFF. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Retrieve Continuous Codes. • **Is DTC B2139 or U1147 retrieved?**	

Pinpoint Test E: DTC B2141 — NVM Configuration Failure

Normal Operation

The powertrain control module (PCM) and instrument cluster verify correct passive anti-theft system (PATS) operation through the standard corporate protocol (SCP) network when the ignition switch is turned to the RUN position.

Possible Causes
- instrument cluster

PINPOINT TEST E: DTC B2141 — NVM CONFIGURATION FAILURE

Test Step	Result / Action to Take
E1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE INSTRUMENT CLUSTER SELF-TEST	
• Retrieve the recorded	**Yes** GO to E2 .

instrument cluster continuous and on-demand self-test DTCs. • **Is DTC B2141 retrieved?**	**No** The system is OK.
E2 CARRY OUT THE KEEP ALIVE MEMORY RESET FROM THE PCM	
• Ignition OFF. • Connect the scan tool. • Ignition ON. • Use the diagnostic tool for PCM active command — KEEP ALIVE MEMORY RESET. • **Does the keep alive memory reset occur?**	**Yes** GO to E3 . **No** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
E3 TRANSFER THE PCM ID	
• Ignition OFF. • Key in the ON position. Leave the key in the ON position for 30 seconds. • Ignition OFF. • Start the engine. • **Does the vehicle start?**	**Yes** The system is OK. **No** GO to E4 .
E4 RETRIEVE THE INSTRUMENT CLUSTER DTCS	
• Enter the following diagnostic mode on the scan tool: CLEAR Instrument Cluster DTCs. • Ignition OFF. • Ignition ON. • Enter the following diagnostic mode	**Yes** REPEAT Step E2. If the fault persists, VERIFY the PCM calibration. If the calibration is OK, INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. CARRY OUT the parameter reset procedure. For additional information, REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. CLEAR the DTCs. REPEAT the self-test. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this service. REFER to Key Programming Using Two Programmed Keys in this procedure. **No**

on the scan tool: RETRIEVE DTCs. • **Is DTC B2141 retrieved?**	REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

Pinpoint Test F: DTCs B1600 and B2431 — PATS Ignition Key Transponder Signal Is Not Received Or Transponder Programming Failed

Normal Operation

The PATS transceiver communicates with the PATS key. The control functions are contained in the instrument cluster. The instrument cluster carries out all of the PATS functions such as receiving the identification code from the PATS key and controlling starter enable. The instrument cluster initiates the key interrogation sequence when the key is inserted in the ignition lock cylinder and when the ignition switch is turned to the RUN or START position.

Possible Causes
- instrument cluster
- PATS transceiver
- PATS key

PINPOINT TEST F: DTCs B1600 AND B2431 — PATS IGNITION KEY TRANSPONDER SIGNAL IS NOT RECEIVED OR TRANSPONDER PROGRAMMING FAILED

NOTE: Large metallic objects, electronic debit transponder devices or a second key on the same key ring as the PATS key may cause vehicle starting problems and record DTCs under certain conditions. If a fault cannot be identified, examine the customer's key for such objects or devices.

If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary problem if they are too close to the key during engine start.

If a problem occurs, turn the ignition switch OFF and restart the engine with all other objects on the key ring held away from the PATS key.

Check to make sure the PATS key used by the customer is an approved Ford PATS key (PATS keys from Rotunda, Huf or Strattec are approved Ford PATS keys).

Test Step	Result / Action to Take
F1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE INSTRUMENT CLUSTER SELF-TEST	
• Retrieve the recorded instrument cluster continuous and on-demand self-test DTCs. • **Is DTC B1600 or B2431 retrieved?**	**Yes** GO to F2 . **No** If other DTCs are retrieved, REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index. If no DTCs are retrieved, the system is OK.
F2 PROGRAM A NEW PATS KEY	

• Ignition OFF. • **NOTE:** Check to make sure the customer and replacement PATS keys are approved Ford encoded PATS keys. Unapproved PATS keys do not always operate correctly over different temperature ranges (PATS keys from Rotunda or Strattec are approved PATS keys). • Cut a new PATS key. • Ignition ON. • Program the new PATS key. Refer to Key Programming Using Diagnostic Equipment in this section. • Ignition OFF. • Ignition ON. • Enter the following diagnostic mode on the scan tool: RETRIEVE DTCs. • **Is DTC B1600 or B2431 still present?**	**Yes** GO to F3 . **No** If no other DTCs are retrieved, the system is OK. If other DTCs are retrieved, REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index.
F3 INSTALL A NEW PATS TRANSCEIVER	
• Ignition OFF. • Install a new PATS transceiver. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • **NOTE:** Use the customer's original PATS key, not the PATS key that was cut in the previous step. • Ignition ON. • Enter the following diagnostic mode on the scan tool: CLEAR Instrument Cluster DTCs. • Enter the following diagnostic mode on the scan tool: RETRIEVE DTCS. • **Is DTC B1600 or B2431 retrieved?**	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . TURN the ignition switch to ON using 2 PATS keys. CARRY OUT the parameter reset procedure. For additional information, REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. CLEAR the DTCs. REPEAT the self-test. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section. **No** The system is OK.

Pinpoint Test G: DTC B1601 — PATS Received An Incorrect Key-Code From The Ignition Key Transponder

Normal Operation

During each key insertion and vehicle start sequence, the instrument cluster and the PATS transceiver read the PATS key identification code.

Possible Causes
- PATS transceiver
- instrument cluster
- PATS key

PINPOINT TEST G: DTC B1601 — PATS RECEIVED AN INCORRECT KEY-CODE FROM THE IGNITION KEY TRANSPONDER

NOTE: Large metallic objects, electronic debit transponder devices or a second key on the same key ring as the PATS key may cause vehicle starting problems and record DTCs under certain conditions. If a fault cannot be identified, examine the customer's key for such objects or devices.

If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary problem if they are too close to the key during engine start.

If a problem occurs, turn ignition switch OFF and restart the engine with all other objects on the key ring held away from the PATS key.

Check to make sure the PATS key used by the customer is an approved Ford PATS key. (PATS keys from Rotunda, Huf or Strattec are approved Ford PATS keys.)

Test Step	Result / Action to Take
G1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE INSTRUMENT CLUSTER SELF-TEST	
• Retrieve the recorded instrument cluster continuous and on-demand self-test DTCs. • **Is DTC B1601 recorded?**	**Yes** GO to G2 . **No** The system is OK. CHECK all customer PATS keys with instrument cluster self-test to verify all other PATS keys are programmed.
G2 CHECK FOR PROGRAMMED PATS KEYS	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Monitor the instrument cluster number of keys PID. • **Does the instrument cluster number of keys PID display 8?**	**Yes** ERASE and PROGRAM the key codes. REFER to Key Programming Using Diagnostic Equipment in this section. CLEAR the DTCs. REPEAT the self-test. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section. **No** GO to G3 .
G3 CHECK THE NUMBER OF PROGRAMMED PATS KEYS AVAILABLE	
• Verify there are at least 2 currently	**Yes** GO to G4 .

programmed PATS keys available with the vehicle. • **Are at least 2 currently programmed PATS keys available with the vehicle?**	**No** CUT new PATS key(s) so that at least 2 PATS keys are available. PROGRAM the PATS keys. REFER to Key Programming Using Diagnostic Equipment in this section. GO to G4 .
G4 VERIFY THE INSTRUMENT CLUSTER SPARE KEY PID INDICATES ENABLE	
• Enter the following diagnostic mode on the scan tool: Instrument Cluster PID. • Monitor the instrument cluster spare key PID. • **Does the instrument cluster spare key PID indicate enable?**	**Yes** GO to G5 . **No** SET the spare key PID to the enable setting. REFER to Key Programming Using Two Programmed Keys in this section. CLEAR the DTCs. REPEAT the self-test. Once completed, GO to G5 .
G5 CHECK THE PATS KEYS FOR CORRECT OPERATION	
• Ignition OFF. • Start the vehicle using the first PATS key. • Start the vehicle with the second PATS key. • Ignition OFF. • **Does the vehicle start correctly using both PATS keys?**	**Yes** The system is OK. If there are additional keys that need to be programmed, REFER to Key Programming Using Two Programmed Keys in this section. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section. **No** GO to G6 .
G6 RETRIEVE THE INSTRUMENT CLUSTER DTCS — CHECK FOR DTC B1601	
• Enter the following diagnostic mode on the scan tool: RETRIEVE DTCs. • Enter the following diagnostic mode on the scan tool: CLEAR Instrument Cluster DTCs. • Carry out the instrument cluster	**Yes** INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. CARRY OUT the parameter reset procedure. For additional information, REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. CLEAR the DTCs. REPEAT the self-test. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section. **No**

self-test using both PATS keys from Step G5. • **Is DTC B1601 retrieved?**	The system is OK. If other DTCs are retrieved, REFER to the Passive Anti-Theft System (PATS) — Diagnostic Trouble Codes (DTC) Index .

Pinpoint Test H: DTC B1602 — PATS Received Invalid Format Of Key-Code From The PATS Key Transponder

Normal Operation

During each key insertion and vehicle start sequence, the instrument cluster and the PATS transceiver read the PATS key identification code.

Possible Causes
- PATS key
- PATS transceiver

PINPOINT TEST H: DTC B1602 — PATS RECEIVED INVALID FORMAT OF KEY-CODE FROM PATS KEY TRANSPONDER

NOTE: Large metallic objects, electronic debit transponder devices, or a second key on the same key ring as the PATS key may cause vehicle starting problems and record DTCs under certain conditions. If a fault cannot be identified, examine the customer's key for such objects or devices.

If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary problem if they are too close to the key during engine start.

If a problem occurs, turn the ignition switch OFF and restart the engine with all other objects on the key ring held away from the PATS key.

Check to make sure the PATS key used by the customer is an approved Ford PATS key. (PATS keys from Rotunda or Strattec are approved Ford PATS keys.)

Test Step	Result / Action to Take
H1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE INSTRUMENT CLUSTER SELF-TEST	
• Retrieve the recorded instrument cluster continuous and on-demand self-test DTCs. • **Is DTC B1602 retrieved?**	**Yes** GO to H2 . **No** The system is OK. CHECK all customer PATS keys with instrument cluster self-test to verify all other PATS keys are programmed.
H2 OBTAIN A NEW PATS KEY	
• Ignition OFF. • Cut a new PATS key.	**Yes** GO to H3 .

• Ignition ON. • Program a new PATS key. Refer to Key Programming Using Diagnostic Equipment in this section. • Carry out the instrument cluster self-test. • **Is DTC B1602 retrieved?**	**No** The system is OK.
H3 INSTALL A NEW PATS TRANSCEIVER	
• Ignition OFF. • Install a new PATS transceiver. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: CLEAR DTCs. • CARRY OUT the instrument cluster self-test. • **Are any DTCs retrieved?**	**Yes** REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index. **No** The system is OK.

Pinpoint Test I: DTC B1681 — PATS Transceiver Signal Is Not Received

Normal Operation

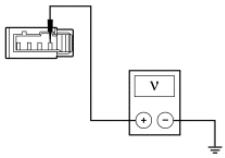
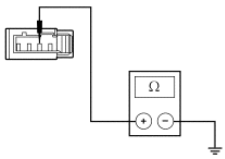
The PATS transceiver receives voltage through central junction box (CJB) fuse 6 (10A) on circuit 29S-GL36 (OG/BU) and ground on circuit 31-GL36 (BK). During each key insertion and vehicle start sequence, the instrument cluster and the PATS transceiver read the PATS key identification code. Communication between the PATS transceiver and the instrument cluster occurs on circuits 8-GL36 (WH/RD) and 10-GL36 (GY/RD).

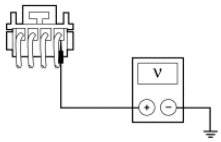
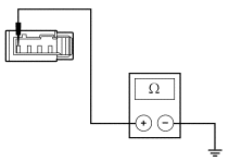
Possible Causes

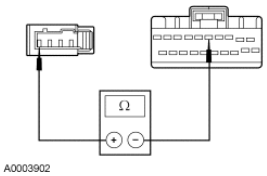
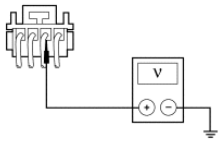
- fuse
- circuit 8-GL36 (WH/RD) open or short to ground
- circuit 10-GL36 (GY/RD) open or short to ground
- circuit 29S-GL36 (OG/BU) open or short to ground
- circuit 31-GL36 (BK) open or short to voltage
- PATS transceiver
- instrument cluster
- PATS key

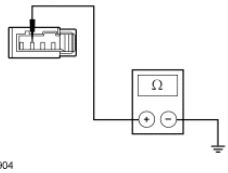
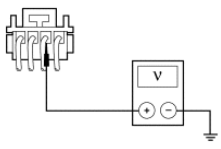
PINPOINT TEST I: DTC B1681 — PATS TRANSCEIVER SIGNAL IS NOT RECEIVED

Test Step	Result / Action to Take
I1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE INSTRUMENT CLUSTER SELF-TEST	
• Retrieve the recorded instrument cluster continuous and on-demand self-test DTCs. • **Is DTC B1681 retrieved?**	**Yes** GO to I2 . **No** The system is OK.

I2 INSPECT THE PATS TRANSCEIVER FOR CORRECT INSTALLATION	
• Ignition OFF. • Verify the PATS transceiver is correctly installed. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • **Is the transceiver correctly installed?**	**Yes** GO to I3 . **No** CORRECT the installation. CLEAR the DTCs. REPEAT the self-test.
I3 CHECK THE PATS TRANSCEIVER CIRCUIT 29S-GL36 (OG/BU) FOR VOLTAGE	
• Ignition OFF. • Disconnect: PATS Transceiver C252. • Ignition ON. • Measure the voltage between the PATS transceiver C252-1, circuit 29S-GL36 (OG/BU), harness side and ground.  A0003898 • **Is the voltage greater than 9 volts?**	**Yes** GO to I4 . **No** VERIFY the CJB fuse 6 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
I4 CHECK THE PATS TRANSCEIVER CIRCUIT 31-GL36 (BK) FOR GROUND	
• Ignition OFF. • Measure the resistance between the PATS transceiver C252-2, circuit 31-GL36 (BK), harness side and ground.  A0003899 • **Is the resistance less than 5 ohms?**	**Yes** GO to I5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I5 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT 10-GL36 (GY/RD) FOR VOLTAGE	
• Connect: PATS Transceiver C252. • Ignition ON. • Measure the voltage by back-probing between the PATS transceiver C252-4, circuit 10-GL36 (GY/RD), harness side and ground.  A0003900 • **Is the voltage greater than 9 volts?**	**Yes** GO to I7 . **No** GO to I6 .
I6 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT 10-GL36 (GY/RD) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: PATS Transceiver C252. • Measure the resistance between the PATS transceiver C252-4, circuit 10-GL36 (GY/RD), harness side and ground.  A0003901 • **Is the resistance greater than 100 ohms?**	**Yes** GO to I7 . **No** CHECK circuit 10-GL36 (GY/RD) for a short to ground with the instrument cluster disconnected. If the circuit is OK, INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. CARRY OUT the parameter reset procedure. For additional information, REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. CLEAR the DTCs. TEST the system for normal operation. If the circuit is not OK, REPAIR circuit 10-GL36 (GY/RD). CLEAR the DTCs. REPEAT the self-test. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section.
I7 CHECK CIRCUIT 10-GL36 (GY/RD) FOR AN OPEN	

• Ignition OFF. • Disconnect: PATS Transceiver C252. • Disconnect: Instrument Cluster C220b. • Measure the resistance between the PATS transceiver C252-4, circuit 10-GL36 (GY/RD), harness side and the instrument cluster C220b-5, circuit 10-GL36 (GY/RD), harness side.  A0003902 • **Is the resistance less than 5 ohms?**	**Yes** GO to I8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
I8 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT 8-GL36 (WH/RD) FOR VOLTAGE	
• Ignition OFF. • Connect: PATS Transceiver C252. • Connect: Instrument Cluster C220b. • Ignition ON. • Measure the voltage by back-probing between the PATS transceiver C252-3, circuit 8-GL36 (WH/RD), harness side and ground.  A0003903 • **Is the voltage greater than 9 volts?**	**Yes** GO to I10 . **No** GO to I9 .
I9 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT 8-GL36 (WH/RD) FOR AN OPEN	

• Ignition OFF. • Disconnect: PATS Transceiver C252. • Measure the resistance between the PATS transceiver C252-3, circuit 8-GL36 (WH/RD), harness side and ground.  A0003904 • **Is the resistance greater than 100 ohms?**	**Yes** GO to I10 . **No** CHECK circuit 8-GL36 (WH/RD) for short to ground with the instrument cluster disconnected. If the circuit is OK, INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. CARRY OUT the parameter reset procedure. For additional information, REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. TEST the system for normal operation. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section. If the circuit is not OK, REPAIR circuit 8-GL36 (WH/RD). CLEAR the DTCs. REPEAT the self-test.
I10 CHECK THE PATS TRANSMIT CIRCUIT 8-GL36 (WH/RD) FOR CORRECT OPERATION	
• Connect: PATS Transceiver C252. • Trigger the instrument cluster active command RF_ SIGNAL to ON while measuring the voltage by back probing between the PATS transceiver C252-3, circuit 8-GL36 (WH/RD), harness side and ground.  A0003903 • **Does the voltage drop from greater than 9 volts to less than 1 volt when the instrument cluster active command RF_ SIGNAL is triggered ON?**	**Yes** GO to I11 . **No** CHECK circuit 8-GL36 (WH/RD) for an open between the instrument cluster C220b-4 and PATS transceiver C252-3. If the circuit is OK, INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. CARRY OUT the parameter reset procedure. For additional information, REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. TEST the system for normal operation. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section. If the circuit is not OK, REPAIR circuit 8-GL36 (WH/RD). CLEAR the DTCs. REPEAT the self-test.
I11 CHECK THE PATS WITH A NEW PATS TRANSCEIVER INSTALLED	

• Ignition OFF. • Install a new PATS transceiver. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • Ignition ON. • Carry out the instrument cluster self-test. • **Is DTC B1681 retrieved?**	**Yes** GO to I12 . **No** The system is OK.
I12 CHECK THE PATS WITH A NEW INSTRUMENT CLUSTER	
• Ignition OFF. • Install a new instrument cluster. Refer to Section 413-01 . • Program the keys. Refer to Key Programming Using Diagnostic Equipment in this section. • Carry out the parameter reset procedure. For additional information, refer to Passive Anti-Theft System (PATS) Parameter Reset in this section. • If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this procedure. Refer to Key Programming Using Two Programmed Keys in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: CLEAR DTCs. • Carry out the instrument cluster self-test. • **Is DTC B1681 retrieved?**	**Yes** REPAIR circuits 8-GL36 (WH/RD), 10-GL36 (GY/RD), 29S-GL36 (OG/BU), and 31-GL36 (BK). CLEAR the DTCs. REPEAT the self-test. **No** If no DTCs are retrieved, the system is OK.

Pinpoint Test J: DTC B2103 — Antenna Not Connected

Normal Operation

During each key insertion and vehicle start sequence, the instrument cluster and the passive anti-theft system (PATS) transceiver read the PATS key identification code.

Possible Causes

- PATS transceiver

PINPOINT TEST J: DTC B2103 — ANTENNA NOT CONNECTED

Test Step	Result / Action to Take
J1 INSPECT THE PATS TRANSCEIVER FOR CORRECT INSTALLATION	
• Ignition OFF. • Verify the PATS transceiver is correctly installed. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • Carry out the instrument cluster self-test. • **Is DTC B2103 retrieved?**	**Yes** INSTALL a new PATS transceiver module. REFER to Passive Anti-Theft System (PATS) Transceiver in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is OK.

Pinpoint Test K: The Vehicle Does Not Start — The Anti-Theft Indicator Does Not Prove Out And Flashes Rapidly

Normal Operation

During each key insertion and vehicle start sequence, the instrument cluster and the passive anti-theft system (PATS) transceiver read the PATS key identification code.

Possible Causes

- Standard corporate protocol (SCP) not connected/failure
- instrument cluster
- powertrain control module (PCM)

PINPOINT TEST K: THE VEHICLE DOES NOT START — THE ANTI-THEFT INDICATOR DOES NOT PROVE OUT AND FLASHES RAPIDLY

Test Step	Result / Action to Take
K1 RECORD THE DTCS FROM THE INSTRUMENT CLUSTER SELF-TEST	
• Ignition ON. • Carry out the instrument cluster self-test. • Retrieve the recorded instrument cluster self-test. • **Is instrument cluster DTC B1213, B1600, B1601, 1602, B1681, B2103, B2139, B2141, B2431 or U1147 retrieved?**	**Yes** REPAIR the instrument cluster DTC. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index. CLEAR the DTCs. REPEAT the self-test. **No** GO to K2 .
K2 CHECK FOR ANTI-THEFT INDICATOR FLASHING FAULT CODE	

SEQUENCE 16	
• **NOTE:** The sequence 1-6 repeats itself. • Check for flashing fault code 16 on the anti-theft indicator. • **When turning key to RUN, does the anti-theft indicator flash rapidly for 1 minute, pause briefly, flash 1 time, pause briefly and then flash 6 times?**	**Yes** GO to K3 . **No** CHECK for other no-start fault(s).
K3 CARRY OUT POWERTRAIN CONTROL MODULE (PCM) DIAGNOSTICS	
• Carry out diagnostics on the PCM. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Does a PCM module concern exist?**	**Yes** Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new instrument cluster. REFER to Section 413-01 . PROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. CARRY OUT the parameter reset procedure. For additional information, REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. TEST the system for normal operation. If the vehicle is equipped with the valet feature, PROGRAM the third key (if available) or INSTRUCT the customer on how to carry out this procedure. REFER to Key Programming Using Two Programmed Keys in this section.

Key Programming Using Two Programmed Keys

NOTE: This procedure only works if 2 or more programmed ignition keys are available and it is desired to program an additional key(s). If 2 keys are not available, follow the procedure in Key Programming Using Diagnostic Equipment in this section.

NOTE: PID SPARE_KY must be enabled for this procedure to operate. If this PID is not enabled, follow the security access procedure. Refer to Anti-Theft Security Access in this section and select SPARE KEY PROGRAMMING SWITCH: ENABLED.

NOTE: If the programming procedure is successful, the new key(s) starts the vehicle and the THEFT indicator illuminates for approximately 3 seconds.

NOTE: If the programming procedure is not successful, the new key(s) does not start the vehicle and the THEFT indicator flashes. If the programming procedure is not successful, leave the ignition switch in the RUN position for at least 30 seconds then repeat the key programming procedure from Step 1. If the failure repeats, refer to Diagnosis and Testing to review the DTCs and carry out pinpoint tests as necessary.

NOTE: A maximum of 8 ignition keys can be programmed to a passive anti-theft system (PATS) equipped vehicle. If more are needed, refer to Unlimited Key Mode Programming in this section.

NOTE: If the steps are not carried out as described, the programming procedure ends.

NOTE: Ignition keys must have the correct mechanical key cut for the vehicle and must be the correct PATS encoded key for the vehicle.

NOTE: If the vehicle is in unlimited key mode, this spare programming procedure still functions. Any 2 keys that can start the vehicle may be used to program in an additional unlimited key.

1. Insert a programmed ignition key into the ignition lock cylinder and turn the ignition switch from OFF to RUN (maintain the ignition switch in RUN for 3 seconds but not longer than 10 seconds).

2. Turn the ignition switch to OFF and remove the first key from the ignition lock cylinder.

3. Within 10 seconds of turning the ignition switch to OFF, insert a second programmed ignition key into the ignition lock cylinder and turn the ignition switch from OFF to RUN (maintain the ignition switch in RUN for 3 seconds but not longer than 10 seconds).

4. Turn the ignition switch to OFF and remove the second key from the ignition lock cylinder.

5. Within 20 seconds of turning the ignition lock cylinder to OFF, insert the unprogrammed ignition key (new key) into the ignition lock cylinder and turn the ignition switch from OFF to RUN (attempt to start the vehicle).

6. If it is desired to program an additional key(s), repeat the key programming procedure from the beginning.

Key Programming Using Diagnostic Equipment

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

NOTE: This procedure is used when a customer needs keys programmed into the system and does not have 2 programmed ignition keys available. This procedure is also useful when a programmed ignition key(s) is lost or a new ignition switch assembly is installed, and it is desired to erase a key(s) from the passive anti-theft system (PATS) memory.

NOTE: This procedure erases all programmed ignition keys from the vehicle memory and the vehicle does not start until 2 keys are reprogrammed to the vehicle.

NOTE: Two PATS encoded keys with the correct mechanical cut must be available to carry out this procedure. One or both of them may be the customer's original keys.

NOTE: If additional keys are to be programmed, refer to Key Programming Using Two Programmed Keys in this section. If the remaining keys are with the customer and are not available with the vehicle, then instruct the customer to refer to the Owner's Guide under the "Programming Spare (SecuriLock® North America, Safeguard® U.K. or PATS for all other markets) Keys Procedure" for instructions on programming the remaining keys.

1. Turn the ignition switch from OFF to RUN.
2. Using the diagnostic tool, follow the SECURITY ACCESS to obtain security access for the instrument cluster. For additional information, refer to Anti-Theft Security Access in this section.
3. From the diagnostic tool menu, select IGNITION KEY CODE ERASE.
4. **NOTE:** Do NOT select any additional commands from this menu.

   Turn the ignition switch to OFF and disconnect the diagnostic tool.
5. Insert the first encoded key into the ignition lock cylinder and turn the ignition switch to RUN for 3 seconds.
6. Insert the second encoded key into the ignition lock cylinder and turn the switch to the RUN position for 3 seconds.
7. Remove the second encoded key from the ignition lock cylinder.
8. The vehicle should now start with both ignition keys.

Key Programming Switch State Control

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

NOTE: The spare key programming switch is a diagnostic tool programmable switch which provides the capability to enable/disable the customer spare key programming procedure. This procedure is in the Owner's Literature spare key programming procedure and in this section under Key Programming Using Two Programmed Keys in this section. This programmable switch is provided as a convenience for customers who may not want the spare key programming procedure available to the vehicle driver.

NOTE: The spare key programming switch state can be viewed by instrument cluster PID SPARE_KY.

1. Insert a programmed ignition key into the ignition lock cylinder and turn the ignition switch to RUN.

2. Using the diagnostic tool select instrument cluster from the menu. Select SECURITY ACCESS to obtain security access. For additional information, refer to Anti-Theft Security Access in this section.

3. **NOTE:** The default setting on delivery of all new vehicles is â ©ENABLE>.

   From the diagnostic tool menu, select SPARE KEY PROGRAMMING SWITCH selection to desired setting:
   â ©ENABLE> Spare key programming procedure is accessible.
   â ©DISABLE> Spare key programming procedure is not accessible.

Unlimited Key Mode Programming

Enabling Unlimited Key Mode

NOTE: Unlimited key mode is intended for use by those fleet customers who need more than 8 keys for their vehicle.

1. The customer must choose a 8-digit, non-00,00,00,00 number to be programmed to all of their vehicles. All customer vehicles need to use the same number. Valid digits are 0-9 plus the letters A-F.

2. Note: If the instrument cluster PID: UNLIMITED TRANSPONDER KEY ID is not displayed on screen, unlimited key mode is turned on, and must be turned off before viewing the stored code. To view/change the stored code, follow the procedure for turning off unlimited key mode below. Check the PID: UNLIMITED TRANSPONDER KEY ID and compare its value against the code chosen in Step 1.

3. Using the diagnostic tool, select instrument cluster from the menu. Follow SECURITY ACCESS to obtain security access. For additional information, refer to Anti-Theft Security Access in this section.
4. Turn OFF the unlimited key mode to view the security key PID.
5. If the Unlimited Transponder Security Key PID was 00,00,00,00, select Active Command: SET UNLIMITED TRANSPONDER KEY. Enter the 8-digit code chosen by the user.
6. Select: ENABLE UNLIMITED KEY MODE, if applicable.
7. Select: IGNITION CODE ERASE.
8. Disconnect the diagnostic tool and turn the ignition keys off.
9. Program in 2 ignition keys to enable the vehicle by cycling keys from OFF to RUN.
10. Program any additional keys using either Key Programming Using Two Programmed Keys or Key Programming Using Diagnostic Equipment in this section.

Disabling Unlimited Key Mode

1. Using a diagnostic tool, select instrument cluster from the menu. Follow SECURITY ACCESS to obtain security access. For additional information, refer to Anti-Theft Security Access in this section.
2. Select: DISABLE UNLIMITED KEY MODE.
3. Select: IGNITION KEY CODE ERASE.
4. Disconnect the diagnostic tool and turn the ignition switch to OFF.
5. Program in 2 keys to enable the vehicle.
6. Program any additional keys using either Key Programming Using Two Programmed Keys or Key Programming Using Diagnostic Equipment in this section.

Anti-Theft Security Access

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool

NOTE: The security access procedure is used to obtain passive anti-theft system (PATS) security access. PATS security access must be granted to erase ignition keys, enable/disable unlimited key mode, and enable/disable the spare key programming switch (PID SPARE_KEY). The security access procedure invokes an inherent 10 minute time delay prior to granting security access during which the diagnostic tool must remain connected to the vehicle. Once security access is granted, a security access command menu is displayed which offers various command options.

NOTE: Once security access is granted, multiple security access commands should be executed (if necessary) prior to exiting the command menu. This avoids the carrying out of an additional security access procedure and the associated 10 minute time delay.

1. From the diagnostic tool select instrument cluster. Select SECURITY ACCESS. This procedure will take 10 minutes to carry out, during which the ignition switch must be in RUN and the diagnostic tool must be connected to the vehicle.

2. After the 10 minute security access procedure is complete, a new menu is displayed with command options. Select only those functions necessary before exiting out of this menu. Once exited out of this menu, the security access procedure must be repeated again to carry out additional commands.

Passive Anti-Theft System (PATS) Parameter Reset

Special Tool(s)

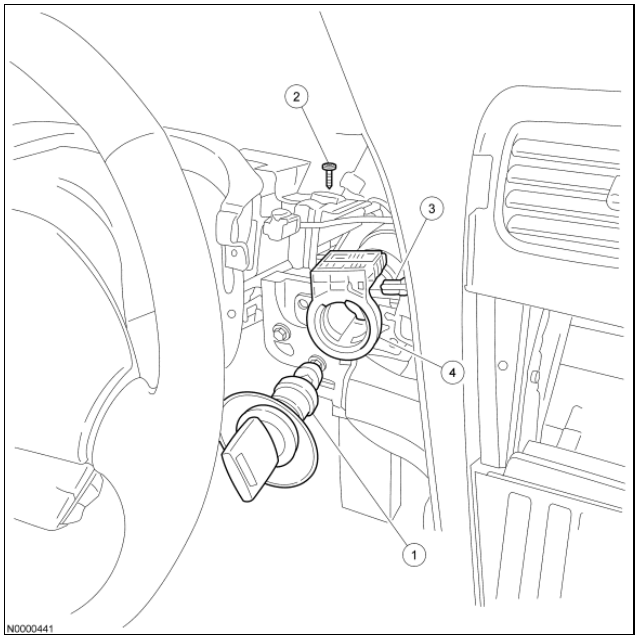
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: A minimum of 2 Passive Anti-Theft System (PATS) keys must be programmed into the Instrument Cluster (IC) to complete this procedure and allow the vehicle to start.

1. Turn the key from the OFF position to the ON position.
2. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.
3. From the scan tool, select: Parameter Reset and follow the on-screen instructions.
4. **NOTE:** If the IC or the IC and the PCM were replaced, updated or reconfigured, follow Steps 4-9. All vehicle keys are erased during the parameter reset procedure. Verify at least 2 vehicle keys are available prior to carrying out the PATS parameter reset. If only the PCM was replaced, go to Step 9.

   From the scan tool, select: Ignition Key Code Erase and follow the on-screen instructions.
5. Turn the key to the OFF position and disconnect the scan tool.
6. Turn the key to the ON position for 6 seconds.
7. Turn the key to the OFF position and remove the key.
8. Insert the second PATS key into the ignition lock cylinder and turn the key to the ON position for 6 seconds.
9. Both keys now start the vehicle.
10. If more keys are required to be programmed, refer to Key Programming Using Two Programmed Keys in this section.
11. Program the Remote Keyless Entry (RKE) transmitter portion of the Integrated Keyhead Transmitter (IKT) PATS keys. For additional information, refer to Section 501-14 .

Passive Anti-Theft System (PATS) Transceiver



Item	Part Number	Description
1	11572	Ignition lock cylinder
2	—	PATS transceiver screw
3	—	PATS tranceiver electrical connector (part of 14401)
4	15607	PATS transceiver

Removal and Installation

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. Remove the instrument cluster finish panel. For additional information, refer to Section 501-12 .
3. Turn the key to the RUN position.
4. Using a suitable tool, push the tab on the cylinder housing and remove the ignition lock cylinder.
5. Remove the PATS transceiver screw.
6. Position the transceiver ring toward the steering column to access the electrical connector.
7. Disconnect the electrical connector and remove the PATS transceiver.
8. To install, reverse the removal procedure.

Universal Transmitter

The HomeLink® universal transmitter is an integral part of the LH sun visor assembly. This universal transmitter provides a convenient way to substitute up to 3 hand-held transmitters with a single built-in device. The transmitter can learn the radio frequency codes of most current transmitters to operate garage doors, entry gates, security systems, and home or office lighting.

Universal Transmitter

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Damaged universal transmitter • Damaged receiver	Battery junction box (BJB) fuse 4 (10A)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Universal Transmitter Is Inoperative

Normal Operation

The universal transmitter is integral to the left sun visor assembly. Under normal operation the universal transmitter can be programmed to operate up to 3 garage doors, entry gates, security systems, and home or office lighting.

Possible Causes

- fuse(s)
- receiver unit
- universal transmitter

PINPOINT TEST A: THE UNIVERSAL TRANSMITTER IS INOPERATIVE

Test Step	Result / Action to Take
A1 CHECK THE LEFT VANITY MIRROR OPERATION	
• Check the illumination of the left sun visor vanity mirror lamps. • **Do the vanity mirror lamps illuminate?**	**Yes** GO to A2 . **No** VERIFY the battery junction box (BJB) fuse 4 (10A) is OK. If OK, refer to Section 417-02 to diagnose the vanity mirror.
A2 PROGRAM A HAND-HELD TRANSMITTER INTO A UNIVERSAL TRANSMITTER	
• **NOTE:** If the garage door is equipped with rolling codes, Refer to Universal Transmitter Programming in this section. • Program the universal transmitter. Refer to Universal Transmitter Programming in this section. • **Does the universal transmitter program successfully?**	**Yes** The universal transmitter is OK. VERIFY the receiver operates correctly. **No** INSTALL a new left sun visor assembly. TEST the system for normal operation.

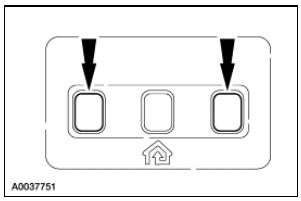
Universal Transmitter Programming

⚠ WARNING: A garage door opening system that cannot stop or reverse itself after detecting an object in its path does not meet current federal safety standards. To decrease the risk of serious injury or death, do not use this HomeLink® universal transmitter with a door opening system that lacks stop and reverse features as required by federal standards. This includes any garage door opening system manufactured before April 1, 1982.

1. **⚠ CAUTION: During this procedure, the system that you are programming will be made to operate. Make sure that people and objects are clear of the garage door or gate being programmed.**

   Verify the hand-held transmitter is operative.

2. Prepare for programming the universal transmitter by erasing all 3 channels. To erase all 3 channels, hold down the 2 outside buttons until the red indicator begins to flash (20-30 seconds). Release both buttons.

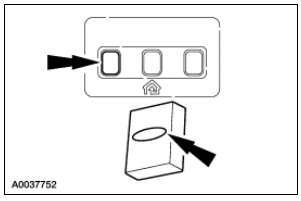


3. Select one of the 3 universal transmitter channels to be programmed by pressing the desired button.

4. Hold the end of the hand-held transmitter 25-51 mm (1-2 inches) from the front surface of the universal transmitter so that the red indicator can still be seen.

5. **NOTE:** For Canadian vehicles only: during programming, the hand-held transmitter may automatically stop transmitting after 2 seconds, which may not be long enough to program the universal transmitter. If programming this type of hand-held transmitter, continue to hold the button on the universal transmitter while re-pressing the hand-held transmitter button every 2 seconds.

   Use both hands to press the hand-held transmitter button and the desired button on the universal transmitter. Do not release either button.



6. Hold down both buttons until the red indicator on the universal transmitter flashes, first slowly and then rapidly. Release both buttons when the rapid flashing begins. The universal transmitter has successfully learned the new frequency signal and can be used in place of the hand-held transmitter(s).

7. **NOTE:** If the hand-held transmitter appears to program the universal transmitter, but does not open the garage door, the garage door opener may have a code protected or rolling code feature.

To operate, simply press the appropriate button on the universal transmitter. The red indicator is on while the signal is being transmitted.

Training a Garage Door Opener Equipped With Rolling Codes

1. Program the hand-held transmitter to the universal transmitter. For additional information, refer to Universal Transmitter Programming in this section.

2. Train the garage door opener receiver to recognize the universal transmitter.
    1. Remove the cover panel from the garage door opener receiver.
    2. The locate the training button on the garage door opener receiver. Location and color of the button may vary by garage door opener manufacturer. Refer to the garage door opener instruction manual or owner literature.
    3. Press the training button on the garage door opener receiver for 1-2 seconds.
    4. Press the programmed universal transmitter button for as long as the universal transmitter red indicator flashes (1-2 seconds). Release the button and re-press the button to confirm that the universal transmitter is trained to the receiver.
    5. The garage door opener should recognize the universal transmitter.

Erasing Channels

1. **NOTE:** Individual channels cannot be erased, but can be reprogrammed using the procedures for programming. For additional information, refer to Universal Transmitter Programming in this section.

   To erase all 3 programmed channels, hold down the 2 outside buttons until the red indicator begins to flash (20-30 seconds). Release both buttons.

Torque Specifications

Description	Nm	lb-in
Front electronic module (FEM) bolts	9	80
Rear electronic module (REM) nuts	7	62

Module Controlled Functions

The multifunction modules consist of the following:

- front electronic module (FEM)
- rear electronic module (REM)
- driver door module (DDM)
- driver seat module (DSM)

Diagnostic Trouble Code (DTC) Chart

Diagnostic Trouble Code Chart

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	Rear Electronic Module (REM)	REFER to Section 413-01 .
B1202	Fuel Sender Circuit Open	Instrument Cluster	REFER to Section 413-01 .
B1204	Fuel Sender Circuit Short to Ground	Instrument Cluster	REFER to Section 413-01 .
B1205	EIC Switch-1 Assembly Circuit Failure	Instrument Cluster	REFER to Section 413-01 .
B1205	EIC Switch-1 Assembly Circuit Failure	Message Center	REFER to Section 413-01 .
B1209	EIC Switch-2 Assembly Circuit Failure	Instrument Cluster	REFER to Section 413-01 .
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	Instrument Cluster	REFER to Section 419-01B .
B1231	Longitudinal Acceleration Threshold Exceeded	Restraint Control Module (RCM)	REFER to Section 501-20B .
B1242	Air Flow Recirculation Door Driver Circuit Failure	Dual Automatic Temperature Control (DATC)	REFER to Section 412-00 .
B1246	Dim Panel Potentiometer Switch Circuit Failure	Instrument Cluster	REFER to Section 413-00 .
B1251	Air Temperature Internal Sensor Circuit Open	DATC	REFER to Section 412-00 .
B1253	Air Temperature Internal Sensor Circuit Short to Ground	DATC	REFER to Section 412-00 .
B1255	Air Temperature External Sensor Circuit Open	DATC	REFER to Section 412-00 .
B1257	Air Temperature External Sensor Circuit Short to Ground	DATC	REFER to Section 412-00 .
B1262	Servo Motor Defrost Circuit Failure	DATC	REFER to Section 412-00 .
B1263	Servo Motor Vent Circuit Failure	DATC	REFER to Section 412-00 .
B1264	Servo Motor Floor Circuit Failure	DATC	REFER to Section 412-00 .
B1265	Servo Motor Cold Air Bypass Circuit Failure	DATC	REFER to Section 412-00 .
B1299	Power Supply Sensor Circuit Short to Ground	Parking Aid Module	REFER to Section 413-13 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14 .
B1309	Power Door Lock Circuit Short to Ground	Driver Door Module (DDM)	REFER to Section 501-14 .

B1310	Power Door Unlock Switch Circuit Failure	REM	REFER to Section 501-14 .
B1317	Battery Voltage High	Instrument Cluster	REFER to Section 414-00 .
B1317	Battery Voltage High	RCM	REFER to Section 414-00 .
B1317	Battery Voltage High	Electronic Parking Brake Module	REFER to Section 414-00 .
B1318	Battery Voltage Low	Instrument Cluster	REFER to Section 414-00 .
B1318	Battery Voltage Low	RCM	REFER to Section 414-00 .
B1318	Battery Voltage Low	Electronic Parking Brake Module	REFER to Section 414-00 .
B1319	Driver Door Ajar Circuit Failure	Front Electronic Module (FEM)	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1341	Power Door Unlock Circuit Short to Ground	DDM	REFER to Section 501-14 .
B1342	ECU is Defective	Parking Aid Module	CLEAR the DTC. REPEAT the parking aid module self-test. If DTC B1342 is retrieved again, INSTALL a new parking aid module. REFER to Section 413-13 . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	FEM	CLEAR the DTC. REPEAT the FEM self-test. If DTC B1342 is retrieved again, INSTALL a new FEM. REFER to Front Electronic Module (FEM) in this section. CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	DATC	CLEAR the DTC. REPEAT the DATC module self-test. If DTC B1342 is retrieved again, INSTALL a new DATC module. REFER to Section 412-00 . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	Climate Control Seat Module	CLEAR the DTC. REPEAT the climate control seat module self-test. If DTC B1342 is retrieved again, INSTALL a new climate control seat module. REFER to Section 501-10 . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	Instrument Cluster	CLEAR the DTC. REPEAT the instrument cluster self-test. If DTC B1342 is retrieved again, INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	Driver Seat Module (DSM)	CLEAR the DTC. REPEAT the DSM self-test. If DTC B1342 is retrieved again, INSTALL a new DSM. REFER to Driver Seat Module (DSM) in this section. CLEAR the DTCs. REPEAT the self test.

B1342	ECU is Defective	DDM	CLEAR the DTC. REPEAT the DDM self-test. If DTC B1342 is retrieved again, INSTALL a new DDM. REFER to Driver Door Module (DDM) in this section. CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	REM	CLEAR the DTC. REPEAT the REM self-test. If DTC B1342 is retrieved again, INSTALL a new REM. REFER to Rear Electronic Module (REM) in this section. CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	RCM	CLEAR the DTC. REPEAT the RCM self-test. If DTC B1342 is retrieved again, INSTALL a new RCM. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	Anti-lock Brake System (ABS)/Traction Control (TC) Module or Stability Assist Module	CLEAR the DTC. REPEAT the ABS/TC module self-test. If DTC B1342 is retrieved again, INSTALL a new ABS/TC module. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU Defective	Message Center	**NOTE:** The message center is part of the instrument cluster. CLEAR the DTC. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	Navigation System Module	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved again, INSTALL a new navigation system module. REFER to Section 415-00 . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Defective	Audio Control Module (ACM)	CLEAR the DTC. CARRY OUT the ACM on-demand self-test. REMOVE the ACM. REFER to Section 415-00 . SEND the ACM to an authorized Ford audio system repair facility if DTC B1342 is retrieved again. TEST the system for normal operation.
B1342	ECU is Defective	Electronic Parking Brake Module	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved again, INSTALL a new electronic parking brake module. REFER to Section 206-05 . CLEAR the DTCs. REPEAT the self-test.
B1352	Ignition Key-in Circuit Failure	Instrument Cluster	REFER to Section 413-01 .
B1358	Ignition Switch or Blower Electronics Circuit Short to Ground	Climate Control Seat Module	REFER to Section 501-10 .
B1416	Power Window LR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .

B1424	Power Window RR Switch Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1470	Lamp Headlamp Input Circuit Failure	Instrument Cluster	REFER to Section 417-01 .
B1479	Low Washer Fluid Level Switch Circuit Failure	FEM	REFER to Section 413-01 .
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 206-09 .
B1483	Brake Pedal Input Circuit Failure	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B1485	Brake Pedal Input Circuit Battery Short	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1526	Keyless Entry Circuit Short to Ground	DDM	REFER to Section 501-14 .
B1530	Memory Set Switch Circuit Short to Ground	DDM	REFER to Section 501-10 .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	REFER to Section 501-10 .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	REFER to Section 501-10 .
B1551	Decklid Release Circuit Failure	FEM	REFER to Section 501-14 .
B1567	Headlamp High-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1567	Headlamp High-Beam Circuit Failure	Instrument Cluster	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal is Not Received	Instrument Cluster	REFER to Section 419-01B .
B1601	PATS Received Incorrect Key-code From Ignition Key Transponder	Instrument Cluster	REFER to Section 419-01B .

B1602	PATS Received Invalid Format of Key-code From Ignition Key Transponder	Instrument Cluster	REFER to Section 419-01B .
B1627	PRNDL Reverse Input Circuit Failure	Parking Aid Module	REFER to Section 413-13 .
B1676	Battery Voltage Out of Range	FEM	REFER to Section 414-00 .
B1676	Battery Voltage Out of Range	REM	REFER to Section 414-00 .
B1676	Battery Voltage Out of Range	Message Center	REFER to Section 414-00 .
B1676	Battery Voltage Out of Range	DATC	REFER to Section 414-00 .
B1676	Battery Voltage Out of Range	DSM	REFER to Section 414-00 .
B1676	Battery Voltage Out of Range	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B1676	Battery Voltage Out of Range	DDM	REFER to Section 414-00 .
B1681	PATS Transceiver Module Signal is Not Received	Instrument Cluster	REFER to Section 419-01B .
B1689	Autolamp Delay Circuit Failure	Instrument Cluster	REFER to Section 417-01 .
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1711	Seat Driver Front Up Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1715	Seat Driver Front Down Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1719	Seat Driver Forward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1723	Seat Driver Rearward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1757	Seat Driver Rear Up/Down Circuit Failure	DSM	REFER to Section 501-10 .
B1761	Seat Driver Front Up/Down Circuit Failure	DSM	REFER to Section 501-10 .
B1765	Seat Driver Forward/Rearward Circuit Failure	DSM	REFER to Section 501-10 .
B1769	Seat Driver Recliner F/R Circuit Failure	DSM	REFER to Section 501-10 .
B1794	Lamp Headlamp Low-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1869	Lamp Air Bag Warning Indicator Circuit Open	RCM	REFER to Section 501-20B .
B1870	Lamp Air Bag Warning Indicator Circuit Short to Battery	RCM	REFER to Section 501-20B .
B1875		Instrument Cluster	REFER to Section 417-01 .

	Turn Signal/Hazard Switch Signal Circuit Failure		
B1891	Air Bag Tone Warning Indicator Circuit Shorted to Battery	RCM	REFER to Section 501-20B .
B1892	Air Bag Tone Warning Indicator Circuit Failure	RCM	REFER to Section 501-20B .
B1921	Air Bag Diagnostic Monitor Ground Circuit Open	RCM	REFER to Section 501-20B .
B1946	Climate Control A/C Post Evaporator Sensor Circuit Failure	DATC	REFER to Section 412-00 .
B1947	Climate Control A/C Post Evaporator Sensor Circuit Short to Ground	DATC	REFER to Section 412-00 .
B1966	A/C Post Heater Sensor Circuit Failure	DATC	REFER to Section 412-00 .
B1967	A/C Post Heater Sensor Circuit Short to Ground	DATC	REFER to Section 412-00 .
B1984	Luggage Compartment Lid Anti-theft Disarm Circuit Short to Ground	REM	REFER to Section 419-01A .
B1990	Pedal Forward/Rearward Potentiometer Feedback Circuit Failure	FEM	REFER to Section 206-00 .
B2078	Driver Airbag Deactivation Indicator Inoperative	RCM	REFER to Section 501-20B .
B2103	Antenna Not Connected	Instrument Cluster	REFER to Section 419-01B .
B2103	Antenna Not Connected	Navigation System Module	REFER to Section 415-00 .
B2112	Door Driver Set Switch Stuck Failure	DDM	REFER to Section 419-01A .
B2116	Door Driver Reset Switch Stuck Failure	DDM	REFER to Section 419-01A .
B2139	SCP Not Configured PCM ID Does Not Match	Instrument Cluster	REFER to Section 419-01B .
B2139	Data Mismatch	Navigation System Module	REFER to Section 415-00 .
B2141	NVM Configuration Failure	Instrument Cluster	REFER to Section 419-01B .
B2143	NVM Memory Failure	DSM	CARRY OUT seat calibration of the DSM. CLEAR the DTCs. REPEAT the self-test. If the DTC resets, INSTALL a new DSM. REFER to Driver Seat Module (DSM) in this section. CARRY OUT seat calibration of the new DSM.
B2143	NVM Memory Failure	Instrument Cluster	CARRY OUT seat calibration of the instrument cluster. CLEAR the DTCs. REPEAT the self-test. If the DTC resets, INSTALL a new instrument cluster. REFER to Section 413-01 . CARRY OUT seat calibration of the new DSM.

B2146	Seat Recline Motor Position Out of Range	DSM	REFER to Section 501-10 .
B2149	Seat Front Vertical Motor Position Out of Range	DSM	REFER to Section 501-10 .
B2152	Seat Rear Vertical Motor Position Out of Range	DSM	REFER to Section 501-10 .
B2155	Seat Horizontal Motor Position Out of Range	DSM	REFER to Section 501-10 .
B2158	Seat Recline Motor Memory Position Out of Range	DSM	REFER to Section 501-10 .
B2161	Seat Front Vertical Motor Memory Position Out of Range	DSM	REFER to Section 501-10 .
B2162	Data Mismatch No.2 (received data does not match what was expected)	Instrument Cluster	REFER to Section 413-01 .
B2164	Seat Rear Vertical Motor Memory Position Out of Range	DSM	REFER to Section 501-10 .
B2167	Seat Horizontal Motor Memory Position Out of Range	DSM	REFER to Section 501-10 .
B2172	Inertia Switch Input Circuit Open	REM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2204	GPS Antenna Connection Open or Short	Navigation System Module	REFER to Section 415-00 .
B2208	Navigation to Head Unit Communication Error	Navigation System Module	REFER to Section 415-00 .
B2243	Driver Rear Door Ajar Circuit Open	REM	REFER to Section 417-02 .
B2245	Passenger Rear Door Ajar Circuit Open	REM	REFER to Section 417-02 .
B2290	Occupant Classification System Fault Front Passenger Side	RCM	REFER to Section 501-20B .
B2292	Restraint System Seatbelt Pretensioner Fault	RCM	REFER to Section 501-20B .
B2293	Restraint System Airbag Fault	RCM	REFER to Section 501-20B .
B2294	Restraint System Curtain Fault	RCM	REFER to Section 501-20B .
B2295	Restraint System Side Airbag Fault	RCM	REFER to Section 501-20B .
B2296	Restraint System Impact Sensor Fault	RCM	REFER to Section 501-20B .

B2312	Mirror Passenger Horizontal Sensor Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Sensor Circuit Failure	FEM	REFER to Section 501-09 .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2328	Column Reach Feedback Potentiometer Circuit Failure	Instrument Cluster	REFER to Section 211-04 .
B2332	Column Tilt Feedback Potentiometer Circuit Failure	Instrument Cluster	REFER to Section 211-04 .
B2336	Mirror Switch Assembly Circuit Failure	DDM	REFER to Section 501-09 .
B2351	Steering Column Switch Signal Circuit Failure	Instrument Cluster	REFER to Section 211-04 .
B2358	Adjustable Pedal Switch Failure	FEM	REFER to Section 206-00 .
B2359	Accessory Delay Output Circuit Failure	DDM	REFER to Section 501-11 .
B2360	Window Motor Control Output Circuit Failure	DDM	REFER to Section 501-11 .
B2380	Heater Coolant Temperature Sensor Circuit Short to Ground	DATC	REFER to Section 412-00 .
B2381	Heater Coolant Temperature Sensor Circuit Open	DATC	REFER to Section 412-00 .
B2401	Audio Tape Deck Mechanism Fault	ACM	VERIFY that no tape is inserted in the ACM. CLEAR and DOCUMENT the DTCs. CARRY OUT the ACM on-demand self-test. If DTC B2401 is retrieved again, REMOVE the ACM. REFER to Section 415-00 . SEND the ACM to an authorized Ford audio system repair facility. TEST the system for normal operation.
B2402	Audio CD/DJ Thermal Shutdown Fault	ACM	REFER to Section 415-00 .
B2403	Audio CD/DJ Internal Fault	ACM	REFER to Section 415-00 .
B2403	Audio CD/DJ Internal Fault	Navigation System Module	REFER to Section 415-00 .
B2404	Audio Steering Wheel Switch Circuit Fault	ACM	REFER to Section 415-00 .
B2404	Audio Steering Wheel Switch Circuit Fault	Navigation System Module	REFER to Section 415-00 .
B2405	Audio Single-Disc CD Player Thermal Shutdown Fault	ACM	REFER to Section 415-00 .
B2406	Audio Single-Disc CD Player Internal Fault	ACM	REFER to Section 415-00 .
B2425		DDM	REFER to Section 501-14 .

	Remote Keyless Entry Rolling Code Out of Synchronization		
B2426	Pass Solar Radiation Sensor Circuit Open	DATC	REFER to Section 412-00 .
B2427	Pass Solar Radiation Sensor Circuit Short to Ground	DATC	REFER to Section 412-00 .
B2428	A/C Post Heater Sensor No. 2 Circuit Failure	DATC	REFER to Section 412-00 .
B2429	A/C Post Heater Sensor No. 2 Circuit Short to Ground	DATC	REFER to Section 412-00 .
B2431	Transponder Programming Failed	Instrument Cluster	REFER to Section 419-01B .
B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to Section 501-20B .
B2438	Passengers Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to Section 501-20B .
B2472	Fog Lamp Switch Failure	Instrument Cluster	REFER to Section 417-01 .
B2477	Module Configuration Failure	Electronic Parking Brake Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	DDM	REFER to Section 418-01 .
B2477	Module Configuration Failure	ACM	REFER to Section 418-01 .
B2477	Module Configuration Failure	RCM	REFER to Section 418-01 .
B2477	Module Configuration Failure	Navigation System Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	Message Center	REFER to Section 418-01 .
B2477	Module Configuration Failure	Instrument Cluster	REFER to Section 418-01 .
B2477	Module Configuration Failure	Stability Assist Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	DATC	REFER to Section 418-01 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
B2477	Module Configuration Failure	ABS/TC Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	Climate Control Seat Module	REFER to Section 418-01 .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
B2486	Climate Controlled Seat Module Voltage Out of Range	Climate Control Seat Module	REFER to Section 501-10 .
B2488	Thumb-wheel Switch Voltage Out of Range High	Climate Control Seat Module	REFER to Section 501-10 .
B2497	Blower RPM Out of Range	Climate Control Seat Module	REFER to Section 501-10 .
B2521	Tach Circuit Failure	Climate Control Seat Module	REFER to Section 501-10 .
B2627	Fuel Sender Circuit Open No. 2	Instrument Cluster	REFER to Section 413-01 .
B2628		Instrument Cluster	REFER to Section 413-01 .

	Fuel Sender Circuit Short to Ground No. 2		
B2633	Driver Front Microphone Circuit Failure	Navigation System Module	REFER to Section 415-00 .
B2691	Front Drivers Seat Belt Buckle Switch Circuit Fault	RCM	REFER to Section 501-20B .
B2692	Front Passengers Seat Belt Buckle Switch Resistance Circuit Fault	RCM	REFER to Section 501-20B .
B2729	Cushion Over-Temp Detected	Climate Control Seat Module	REFER to Section 501-10 .
B2730	Back-Over Temp Detected	Climate Control Seat Module	REFER to Section 501-10 .
B2731	Differential Temperature Fault	Climate Control Seat Module	REFER to Section 501-10 .
B2734	Pedal Travel Sensor Supply Error	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B2736	Pedal Travel Sensor Circuit Fault	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B2737	Pedal Travel Sensor Jammed Error	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B2738	Pedal Travel Sensor Velocity Error	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B2740	Pedal Travel Sensor Spike Error	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B2741	Sensor Cluster Loop End	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B2792	Heat Switch Short to Ground	Climate Control Seat Module	REFER to Section 501-10 .
B2793	Cool Switch Short to Ground	Climate Control Seat Module	REFER to Section 501-10 .
B2795	Driver Solar Radiation Sensor Circuit Short to Ground	DATC	REFER to Section 412-00 .
B2796	Driver Solar Radiation Sensor Circuit Open	DATC	REFER to Section 412-00 .
B2797	Driver Water Valve Circuit Open	DATC	REFER to Section 412-00 .
B2798	Driver Water Valve Circuit Short	DATC	REFER to Section 412-00 .
B2799	Pass Water Valve Circuit Open	DATC	REFER to Section 412-00 .
B2800	Pass Water Valve Circuit Short	DATC	REFER to Section 412-00 .
B2844	Ignition Voltage Out of Range	Parking Aid Module	REFER to Section 413-13 .
B2858	H/U is Defective	Navigation System Module	REFER to Section 415-00 .
B2879	Fuel Tank Jet Pump Fault	Instrument Cluster	REFER to Section 413-01 .

B2900	VIN Mismatch	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
B2913	Audio Sub-Woofer Not Connected	Navigation System Module	REFER to Section 415-00 .
C1094	Park Brake Apply Switch Circuit Failure	Electronic Parking Brake Module	REFER to Section 206-00 .
C1095	Hydraulic Pump Motor Circuit Failure	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1132	Clutch Position Circuit Short to Ground	Electronic Parking Brake Module	REFER to Section 206-05 .
C1133	Clutch Position Circuit Short to Battery	Electronic Parking Brake Module	REFER to Section 206-05 .
C1134	Gear Shift Position Circuit Short to Ground	Electronic Parking Brake Module	REFER to Section 206-05 .
C1135	Gear Shift Position Circuit Short to Battery	Electronic Parking Brake Module	REFER to Section 206-05 .
C1145	Speed Wheel Sensor RF Input Circuit Failure	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1155	Speed Wheel Sensor LF Input Circuit Failure	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1165	Speed Wheel Sensor RR Input Circuit Failure	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1175	Speed Wheel Sensor LR Input Circuit Failure	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1192	Vehicle Speed Circuit Failure	Navigation System Module	REFER to Section 415-00 .
C1233	Speed Wheel LF Input Signal Missing	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1234	Speed Wheel RF Input Signal Missing	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1235	Speed Wheel RR Input Signal Missing	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1236	Speed Wheel LR Input Signal Missing	ABS/TC Module or Stability Assist Module	REFER to Section 206-09 .
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	Stability Assist Module	REFER to Section 206-09 .
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	Stability Assist Module	REFER to Section 206-09 .
C1279	Yaw Rate Sensor Circuit Failure	Stability Assist Module	REFER to Section 206-09 .

C1280	Yaw Rate Sensor Signal Fault	Stability Assist Module	REFER to Section 206-09 .
C1281	Lateral Accelerometer Circuit Failure	Stability Assist Module	REFER to Section 206-09 .
C1282	Lateral Accelerometer Signal Fault	Stability Assist Module	REFER to Section 206-09 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1285	Booster Solenoid Circuit Failure	Stability Assist Module	REFER to Section 206-09 .
C1287	Booster Pedal Force Switch Circuit Failure	Stability Assist Module	REFER to Section 206-09 .
C1288	Pressure Transducer Main/Primary Input Circuit Failure	Stability Assist Module	REFER to Section 206-09 .
C1408	Parking Brake Release Switch Circuit Out of Range	Electronic Parking Brake Module	REFER to Section 206-05 .
C1409	Parking Brake Apply Switch Circuit Out of Range	Electronic Parking Brake Module	REFER to Section 206-05 .
C1414	Incorrect Module Design Level	RCM	REFER to Section 501-20B .
C1440	Pressure Transducer Main/Primary Signal Faulted	Stability Assist Module	REFER to Section 206-09 .
C1700	LR Sensor Circuit Failure or Blockage	Parking Aid Module	REFER to Section 413-13 .
C1703	RR Sensor Circuit Failure or Blockage	Parking Aid Module	REFER to Section 413-13 .
C1730	Reference Voltage Out of Range (+5 V)	Stability Assist Module	REFER to Section 206-09 .
C1769	Park Brake Apply Switch Circuit Short to Ground	Electronic Parking Brake Module	REFER to Section 206-05 .
C1782	Park Brake Release Switch Circuit Failure	Electronic Parking Brake Module	REFER to Section 206-05 .
C1783	Park Brake Release Switch Circuit Short to Ground	Electronic Parking Brake Module	REFER to Section 206-05 .
C1784	EBP Motor Output Short to Ground	Electronic Parking Brake Module	REFER to Section 206-05 .
C1785	EBP Motor Output Open Circuit	Electronic Parking Brake Module	REFER to Section 206-05 .
C1786	EBP Motor Output Battery Short to Ground	Electronic Parking Brake Module	REFER to Section 206-05 .
C1799	Hall Effect Circuit Failure	Electronic Parking Brake Module	REFER to Section 206-05 .
C1801	Motor Engage Current Reached Before Full Apply Travel Distance	Electronic Parking Brake Module	REFER to Section 206-05 .
C1802	Motor Engage Current Not Reached or Traveled Too Far Upon Apply	Electronic Parking Brake Module	REFER to Section 206-05 .
C1803	Motor Disengage Full Travel Distance Not Reached Upon Release	Electronic Parking Brake Module	REFER to Section 206-05 .

C1805	Mismatched PCM and/or Stability Assist Module	Stability Assist Module	CHECK for correct component and configuration for the PCM and stability assist module. INSTALL a new stability assist module as necessary. REFER to Section 206-09 . CLEAR the DTC. REPEAT the self-test.
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
C1947	Seat Track Position Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
C1948	Seat Track Position Switch Circuit Resistance Out of Range	RCM	REFER to Section 501-20B .
C1963	Stability Control Inhibit Warning	Stability Assist Module	REFER to Section 206-09 .
C1969	TC/YC Switch Lamp Circuit Fault	Stability Assist Module	REFER to Section 206-09 .
C1981	Front Drivers Seat Track Position Switch Circuit Fault	RCM	REFER to Section 501-20B .
C1983	Radar Sensor Fault	Parking Aid Module	REFER to Section 413-13 .
C1984	Radar Sensor Circuit Failure	Parking Aid Module	REFER to Section 413-13 .
C1985	Back Up Aid Disable Switch Stuck Low	Parking Aid Module	REFER to Section 413-13 .
C1987	Yellow Fault Warning Lamp Indicator Short to Battery	Electronic Parking Brake Module	REFER to Section 206-05 .
C1988	Yellow Fault Warning Lamp Indicator Circuit Failure	Electronic Parking Brake Module	REFER to Section 206-05 .
C1989	Park Brake Apply and Release Switch Contacts Energized Simultaneously	Electronic Parking Brake Module	REFER to Section 206-05 .
C1991	Module Calibration Failure	Stability Assist Module	REFER to Section 206-09 .
C1992	Vehicle Speed Circuit Failure	Parking Aid Module	REFER to Section 413-13 .
C1996	Active Yaw Control Disabled	Stability Assist Module	REFER to Section 206-09 .
C1998	Module Calibration Not Complete	Stability Assist Module	REFER to Section 206-09 .
C2777	Sensor Cluster Bus Failure	Stability Assist Module	REFER to Section 206-09 .
C2778	Sensor Power Supply Failure	Stability Assist Module	REFER to Section 206-09 .
C2790	LED Array Circuit Failure	Parking Aid Module	REFER to Section 413-13 .
P0707	Transmission Range Sensor Circuit Low Input	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0117	ECT Circuit Low Input	Powertrain Control Module (PCM)	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

P0112	IAT Circuit Low Input	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0113	IAT Indicates -40°C (-40°F) Open Circuit	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0114	IAT Out of On-board Diagnostic Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1116	ECT Out of On-board Diagnostic Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0118	ECT Indicates -40°C (-40°F)	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0122	TP Sensor A Circuit Low Input	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0123	TP Sensor A Circuit High Input	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0442	Small Leak Detected in EVAP System (As Small as 1.02 mm [0.040 inch])	PCM	REFER to Section 310-00 .
P0455	Major Leak or No Flow Detected	PCM	REFER to Section 310-00 .
P0457	Check for Missing or Leaking Fuel Filler Cap	PCM	REFER to Section 310-00 .
P0500	Vehicle Speed Sensor Malfunction	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0501	Vehicle Speed Sensor Range/Performance	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0502	Vehicle Speed Sensor Low Input	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0503	Vehicle Speed Sensor Intermittent	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0703	Brake Switch Input Malfunction	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0705	Digital TR Circuit Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0708	Digital TR Sensor	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0712	Transmission Fluid Temperature (TFT) Sensor Circuit Low Input	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED)

			manual.
P0713	-40°C (-40°F) Indicated TFT Sensor Circuit Open	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0715	TSS	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0717	TSS	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0718	TSS	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0720	OSS	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0721	Output Shaft Speed Sensor Signal Noisy	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0722	OSS	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0731	1st Gear Error	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0732	2nd Gear Error	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0733	3rd Gear Error	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0734	4th Gear Error	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0735	5th Gear Error	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0741	TCC	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0743	TCC Solenoid Circuit Fails to Provide Voltage Drop Across Solenoid. Circuit Open or Shorted or PCM Driver Failure During On-board Diagnostics.	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0745, P1747	PCA	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0750	SSA Solenoid Circuit Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED)

			manual.
P0753	SSA	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0755	SSB	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0758	SSB Solenoid Circuit Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0760	SSC Solenoid Circuit Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0763	SSC	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0765	SSD Solenoid Circuit Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0768	SSD Solenoid Circuit Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0775, P1789	PCB Solenoid Circuit Failure, Shorted Circuit	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0779	PCB Solenoid Intermittent Short to Ground	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0791	Intermediate Shaft Speed Sensor Signal Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0794	Intermediate Shaft Speed Sensor Signal Intermittent	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0795, P0797	PCC	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0796	PCC Solenoid Circuit Open	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0799	PCC Solenoid Intermittent Short to Ground	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0814	J-GATE Circuit Input Signal Failed	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0815	SST +/- Circuit Input Signal Failed	PCM	REFER to Section 307-05 .
P0840	Reverse Pressure Switch Circuit Input Signal Failed	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED)

			manual.
P1120	TP Sensor Out of Range Low (RATCH too Low)	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1124	TP Voltage High/Low for On-board Diagnostic	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1183	Engine Oil Temperature Circuit Malfunction	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1184	Engine Oil Temperature Out of Self Test Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1430	SCP (J1850) Invalid Data for Function Read Fuel System	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1443	Very Small or No Purge Flow Detected	PCM	REFER to Section 310-00 .
P1450	Excessive Vacuum Detected in the Fuel Tank	PCM	REFER to Section 310-00 .
P1460	WOT A/C Cutout Internal Driver Malfunction	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1461	A/C Pressure Sensor Circuit High Input	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1462	A/C Pressure Sensor Circuit Low Input	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1463	A/C Pressure Sensor Insufficient Pressure Variation	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1464	A/C Demand Out of Self-test Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1469	Low A/C Cycling Period	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1474	Low Speed Fan Internal Driver Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1479	High Speed Fan Internal Driver Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1565	Speed Control Command Switches High/Out of Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1566	Speed Control Command Switches Low/Out of Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

P1567	NGSC Drive Fault	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1572	Brake On/Off Failure	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1636	SSx ISIG Communication Error	PCM	INSTALL a new PCM. REFER to Section 303-14 .
P1641	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	ABS/TC Module or Stability Assist Module	REFER to Section 418-00 .
P1641	Fuel Pump Primary Circuit Failure	REM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1700	Internal Component Failure. Direct One-way Clutch Failure	PCM	If other solenoid DTCs are present, DIAGNOSE and REPAIR them first. CLEAR the DTCs and DRIVE the vehicle. If P1700 returns, DISASSEMBLE the transmission and INSPECT the direct one-way clutch. REPAIR as required. CLEAR the DTC. DRIVE the vehicle and VERIFY the repair.
P1702	Digital TR Signal Intermittent, Code P0705, P0708 Are Set	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1703	BPP	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1704	Digital TR Not in P Or N Positions During KOEO/KOER	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1705	Digital TR Not in PARK or NEUTRAL During KOEO/KOER	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1711	TFT Out of On-board Diagnostic Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1713	No Change in TFT - Low Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1714	SSA Inoperative	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1715	SSB Inoperative	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1716	SSC Inoperative	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1717	SSD Inoperative	PCM	

			REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1718	No Change in TFT - High Range	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1740	TCC Inoperative	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1746	PCA Solenoid Circuit Open	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1760	PCA Solenoid Intermittent Short to Ground	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1780	TCS Input Incorrect Per Selected Position	PCM	RERUN the on-board diagnostic and CYCLE the switch. REFER to Section 307-05 .
P1783	Transmission Overtemp Condition Indicated	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1788	PCB Solenoid Circuit Open	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1009	SCP (J1850) Invalid or Missing Data for Engine Torque	ABS/TC Module or Stability Assist Module	REFER to Section 418-00 .
U1016	SCP Invalid DATA (PCM)	Navigation System Module	REFER to Section 415-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	Electronic Parking Brake Module	REFER to Section 418-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	REFER to Section 418-00 .
U1027	SCP (J1850) Bus Invalid or Missing Data for Engine RPM	ABS/TC Module or Stability Assist Module	REFER to Section 418-00 .
U1027	SCP (J1850) Bus Invalid or Missing Data for Engine RPM	FEM	REFER to Section 418-00 .
U1040	SCP (J1850) Invalid or Missing Data for Vehicle Speed	Electronic Parking Brake Module	REFER to Section 418-00 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	FEM	REFER to Section 418-00 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	REM	REFER to Section 418-00 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	DDM	REFER to Section 418-00 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	Instrument Cluster	REFER to Section 418-00 .
U1051	SCP (J1850) Invalid or Missing Data for Brakes	Electronic Parking Brake Module	REFER to Section 418-00 .

U1053	SCP (J1850) Invalid or Missing Data for Steering/ Steering Wheel	PCM	REFER to Section 418-00 .
U1058	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/ PRNDL	Electronic Parking Brake Module	REFER to Section 418-00 .
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/ PRNDL	PCM	REFER to Section 418-00 .
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/ PRNDL	ABS/TC Module or Stability Assist Module	REFER to Section 418-00 .
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/ PRNDL	FEM	REFER to Section 418-00 .
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/ PRNDL	REM	REFER to Section 418-00 .
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/ PRNDL	DDM	REFER to Section 418-00 .
U1073	SCP (J1850) Invalid Or Missing Data for Engine Coolant	ABS/TC Module or Stability Assist Module	REFER to Section 418-00 .
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant	Instrument Cluster	REFER to Section 413-01 .
U1083	SCP (J1850) Invalid or Missing Data for Engine Systems Other	PCM	REFER to Section 418-00 .
U1098	SCP (J1850) Invalid or Missing Data for Vehicle Speed Control	PCM	REFER to Section 418-00 .
U1123	SCP (J1850) Invalid or Missing Data for Odometer	Instrument Cluster	REFER to Section 418-00 .
U1123	SCP (J1850) Invalid or Missing Data for Odometer	Message Center	REFER to Section 418-00 .
U1134	SCP (J1850) Invalid or Missing Data Ignition Switch/Starter	Electronic Parking Brake Module	REFER to Section 418-00 .
U1136	SCP (J1850) Invalid or Missing Data for Telltales	PCM	REFER to Section 418-00 .
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security System	ABS/TC Module or Stability Assist Module	REFER to Section 418-00 .
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security System	PCM, Instrument Cluster	REFER to Section 418-00 .
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	FEM, REM	REFER to Section 418-00 .
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	FEM	REFER to Section 418-00 .

U1243	SCP (J1850) Invalid or Missing Data for Exterior Environment	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1262	SCP (J1850) Communication Bus Fault	Electronic Parking Brake Module	REFER to Section 418-00 .
U1262	SCP (J1850) Communication Bus Fault	Network Fault	REFER to Section 418-00 .
U1262	SCP (J1850) Communication Bus Fault	Instrument Cluster	REFER to Section 418-00 .
U1262	SCP (J1850) Communication Bus Fault	ABS/TC Module Or Stability Assist Module	REFER to Section 418-00 .
U1262	SCP (J1850) Communication Bus Fault	Message Center	REFER to Section 418-00 .
U1430	SCP (J1850) Invalid Data for Function Read Fuel System	Message Center	REFER to Section 418-00 .
U1751	SCP (J1850) SCLM System Status Missing From REM	Instrument Cluster	REFER to Section 418-00 .
U1752	SCP (J1850) SCLM System Status Missing From FEM	Instrument Cluster	REFER to Section 418-00 .
U1901	CAN Network #2 Communication BUS Fault Receive Error	ABS/TC Module or Stability Assist Module	REFER to Section 418-00 .
U1950	UBP Communication Bus Fault	Parking Aid Module	REFER to Section 418-00 .
U2306	Transmission PRNDL Range Selected Status Invalid	Parking Aid Module	REFER to Section 413-13 .
U2150	SCP (J1850) Invalid Data From REM	Instrument Cluster	REFER to Section 418-00 .
U2152	SCP (J1850) Invalid Data From FEM	Instrument Cluster	REFER to Section 418-00 .
U2195	REM (J1850) Invalid DATA From SCLM	Instrument Cluster	REFER to Section 418-00 .
U2362	UBP Invalid Data From Node ID $98	Climate Control Seat Module	REFER to Section 501-10 .

Front Electronic Module (FEM)

Refer to Wiring Diagrams Cell 59 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Central junction box (CJB) fuses: ♦ 20 (10A) ♦ 30 (5A) • Wiring harness • Connector(s)

3. If an obvious cause for an observed or a reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:

- check that the program card is correctly installed.

- check the connections to the vehicle.
- check the ignition switch position.

5. If diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the data link diagnostics test. If the diagnostic tool responds with:

- SCP or UBP circuits fault; all electronic control units no response/not equipped, refer to Section 418-00 .
- No response/not equipped for FEM, GO to Pinpoint Test A .
- System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out self-test diagnostics for the DSM.

7. If the DTCs retrieved are related to the concern, go to the Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: No Communication With The Front Electronic Module (FEM)

Normal Operation

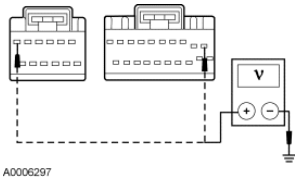
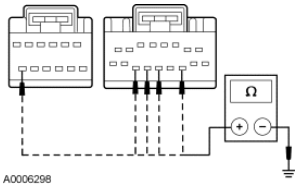
The FEM controls the RH exterior mirrors, the power adjustable pedals, both interior and exterior lighting active anti-theft functions, and the brake shift interlock. Power is supplied through the central junction box (CJB) circuits 29-DK20 (OG/GN), 29-DK22 (OG/WH) and grounded through circuits 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD), and 31-DK20D (BK/RD).

Possible Causes

- fuse(s)
- circuit 29-DK20 (OG/GN) open or short to ground
- circuit 29S-DK22 (OG/WH) open or short to ground
- circuit 31-DK20 (BK/RD) open
- circuit 31-DK20A (BK/RD) open
- circuit 31-DK20B (BK/RD) open
- circuit 31-DK20C (BK/RD) open
- circuit 31-DK20D (BK/RD) open
- FEM

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE (FEM)

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe Adaptor(s) may damage the connector.

Test Step	Result / Action to Take
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK221 (OG/WH) FOR VOLTAGE	
• Ignition OFF. • Disconnect: FEM C201a. • Disconnect: FEM C201c. • Ignition ON. • Measure the voltage between the FEM C201a-1, circuit 29S-DK22 (OG/WH), harness side and ground; and between FEM C201c-6, circuit 29-DK20 (OG/GN), harness side and ground.  A0006297 • **Are the voltages greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY the CJB fuses 20 (10A) and 30 (5A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
A2 CHECK THE FEM GROUND CIRCUITS FOR AN OPEN	
• Ignition OFF. • Using the following table, measure the resistance between the FEM connector, harness side and ground: **Connector-Pin** / **Circuit** C201a-11 / 31-DK20A (BK/RD) C201a-13 / 31-DK20B (BK/RD) C201a-14 / 31-DK20C (BK/RD) C201a-15 / 31-DK20D (BK/RD) C201c-12 / 31-DK20 (BK/RD)  A0006298 • **Are the resistances less than 5 ohms?**	**Yes** REFER to Section 418-00 to diagnose the communication network. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Rear Electronic Module (REM)

Refer to Wiring Diagrams Cell 59 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Central junction box (CJB) fuse 20 (10A) • Wiring harness • Connector(s) • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:

- check that the program card is correctly installed.
- check the connections to the vehicle.

- check the ignition switch position.

5. If diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:

- SCP or UBP circuits fault; all electronic control units, no response/not equipped, refer to Section 418-00 .
- No response/not equipped for REM, GO to Pinpoint Test B .
- System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the REM.

7. If the DTCs retrieved are related to the concern, go to the Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test B: No Communication With The Rear Electronic Module (REM)

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation

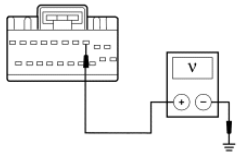
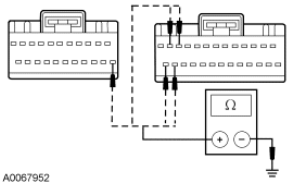
The exterior lights, interior lights, and active anti-theft functions are controlled by the REM. Power is supplied through the central junction box (CJB) on circuit 29-DK31 (OG/BK), and grounded through circuits 31-DK30D (BK/OG), 31-DK30E (BK/OG), 31-DK30F (BK/OG), 31-DK30G (BK/OG) and 31-DK30H (BK/OG).

Possible Causes

- fuse
- circuit 29-DK31 (OG/BK) open or short to ground
- circuit 31-DK30D (BK/OG) open
- circuit 31-DK30E (BK/OG) open
- circuit 31-DK30F (BK/OG) open
- circuit 31-DK30G (BK/OG) open
- circuit 31-DK30H (BK/OG) open
- REM

PINPOINT TEST B: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE (REM)

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe Adaptor(s) may damage the connector.

Test Step	Result / Action to Take
B1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	
• Ignition OFF. • Disconnect: REM C420d. • Ignition ON. • Measure the voltage between the REM C420d-3, circuit 29-DK31 (OG/BK), harness side and ground.  A0067904 • **Is the voltage greater than 10 volts?**	**Yes** GO to B2 . **No** VERIFY the CJB fuse 20 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B2 CHECK THE REM GROUND CIRCUITS FOR AN OPEN	
• Disconnect: REM C420b. • Disconnect: REM C420c. • Ignition OFF. • Use the following table to measure the resistance between the REM connector, harness side and ground: **Connector-Pin** / **Circuit** C420b-12 / 31-DK30H (BK/OG) C420c-11 / 31-DK30D (BK/OG) C420c-12 / 31-DK30E (BK/OG) C420c-25 / 31-DK30F (BK/OG) C420c-26 / 31-DK30G (BK/OG)  A0067952 • **Are the resistances less than 5 ohms?**	**Yes** REFER to Section 418-00 to diagnose the communication network. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Driver Door Module (DDM)

Refer to Wiring Diagrams Cell 59 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

NOTE: Upon installation of a new DDM, the module must be reconfigured.

Refer to Section 418-01 . The DDM controls many functions including, power door locks and remote keyless entry (RKE).

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Central junction box (CJB) fuse(s): ♦ 7 (5A) ♦ 22 (10A) • Wiring harness • Connector(s) • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:

- check that the program card is correctly installed.
- check the connections to the vehicle.
- check the ignition switch position.

5. If diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:

- SCP or UBP circuits fault; all electronic control units, no response/not equipped, refer to Section 418-00 .
- No response/not equipped for DDM, GO to Pinpoint Test C .
- System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out self-test diagnostics for the DSM.

7. If the DTCs retrieved are related to the concern, go to the Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test C: No Communication With The Driver Door Module (DDM)

Normal Operation

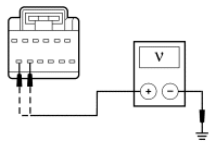
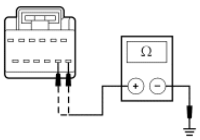
The LH exterior mirror, remote keyless entry (RKE), and power locks are controlled by the DDM. Voltage is supplied through the central junction box (CJB) on circuits 29-AJ80 (OG) and 29S-AJ86 (OG/BU) and grounded through circuits 91-AJ80 (BN/BU) and 31-AJ80B (BK/OG).

Possible Causes

- fuse(s)
- circuit 29-AJ80 (OG) open or short to ground
- circuit 29S-AJ86 (OG/BU) open or short to ground
- circuit 31-AJ80B (BK/OG) open
- circuit 91-AJ80 (BN/BU) open

PINPOINT TEST C: NO COMMUNICATION WITH THE DRIVER DOOR MODULE (DDM)

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe Adaptor(s) may damage the connector.

Test Step	Result / Action to Take
C1 CHECK CIRCUITS 29-AJ80 (OG) AND 29S-AJ86 (OG/BU) FOR VOLTAGE	
• Ignition OFF. • Disconnect: DDM C501a. • Ignition ON. • Measure the voltage between the DDM C501a-11, circuit 29-AJ80 (OG), harness side and ground; and between the DDM C501a-12, circuit 29S-AJ86 (OG/BU), harness side and ground.  A0067905 • **Are the voltages greater than 10 volts?**	**Yes** GO to C2 . **No** VERIFY the CJB fuses 7 (5A) and 22 (10A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
C2 CHECK CIRCUITS 31-AJ80B (BK/OG) AND 91-AJ80 (BN/BU) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the DDM C501a-7, circuit 91-AJ80 (BN/BU), harness side and ground; and between the DDM C501a-8, circuit 31-AJ80B (BK/OG), harness side and ground.  A0067906 • **Is the resistance less than 10 ohms?**	**Yes** REFER to Section 418-00 to diagnose the communication network. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Driver Seat Module (DSM)

Refer to Wiring Diagrams Cell 59 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2332-A	Worldwide Diagnostic System (WDS) Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
ST2574-A	Flex Probe Kit 105-R025B or equivalent

Principles of Operation

The DSM allows automatic positioning of the memory driver seat to 2 programmable positions. Refer to Section 501-10 .

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Battery junction box (BJB) fuse 21 (20A) • Central junction box (CJB) fuse 7 (5A) • Wiring harness • Connector(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:

- check that the program card is correctly installed.
- check the connections to the vehicle.
- check the ignition switch position.

5. If diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.

6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:

- SCP or UBP circuits fault; all electronic control units no response/not equipped, refer to Section 418-00 .
- No response, not equipped for DSM, GO to Pinpoint Test D .
- System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out self-test diagnostics for the DSM.

7. If the DTCs retrieved are related to the concern, go to the Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test D: No Communication With The Driver Seat Module (DSM)

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation

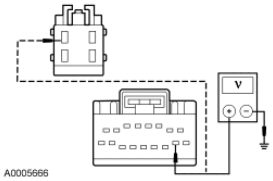
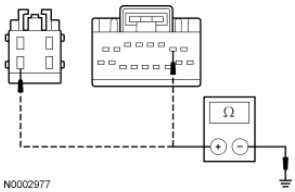
The power driver seat is controlled by the DSM. Voltage is supplied through the central junction box (CJB) and battery junction box (BJB) on circuits 29-AH80 (OG/WH) and 30-AH80 (RD). The DSM is grounded through circuits 31-AH80 (BK) and 91-AH80 (BN/WH).

Possible Causes

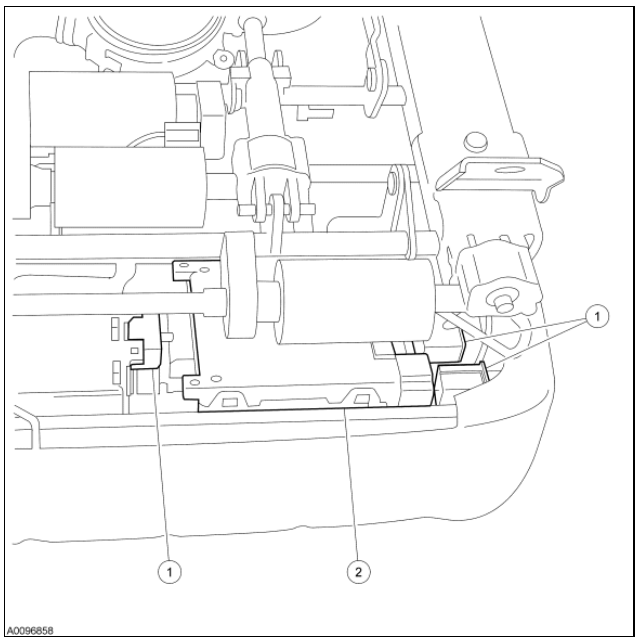
- fuse(s)
- circuit 29-AH80 (OG/WH) open or short to ground
- circuit 30-AH80 (RD) open or short to ground
- circuit 31-AH80 (BK) open
- circuit 91-AH80 (BN/WH) open

PINPOINT TEST D: NO COMMUNICATION WITH THE DRIVER SEAT MODULE (DSM)

⚠ CAUTION: Use the correct probe adaptor(s) when making measurements. Failure to use the correct probe Adaptor(s) may damage the connector.

Test Step	Result / Action to Take
D1 CHECK CIRCUITS 29-AH80 (OG/WH) AND 30-AH80 (RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: DSM C341b. • Disconnect: DSM C341c. • Ignition ON. • Measure the voltage between the DSM C341b-4, circuit 30-AH80 (RD), harness side and ground; and between the DSM C341c-10, circuit 29-AH80 (OG/WH), harness side and ground.  A0005666 • **Are the voltages greater than 10 volts?**	**Yes** GO to D2 . **No** VERIFY the BJB fuse 21 (20A) and the CJB fuse 7 (5A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
D2 CHECK CIRCUITS 31-AH80 (BK) AND 91-AH80 (BN/WH) FOR AN OPEN	
• Measure the resistance between the DSM C341b-3, circuit 31-AH80 (BK), harness side and ground; and between the DSM C341c-2, circuit 91-AH80 (BN/WH), harness side and ground.  N0002977 • **Are the resistances less than 5 ohms?**	**Yes** REFER to Section 418-00 to diagnose the communication network. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Driver Seat Module (DSM)



Item	Part Number	Description
1	—	DSM electrical connectors
2	13C789	DSM

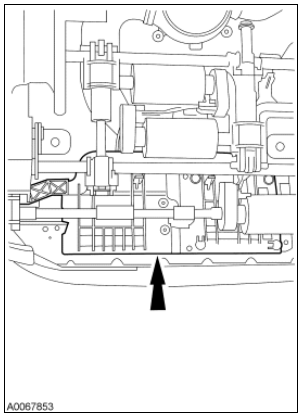
Removal and Installation

1. **⚠ CAUTION: Prior to the removal of the module, it is necessary to upload module configuration information to the appropriate diagnostic equipment. This information needs to be downloaded into the new module once installed. For additional information, refer to Section 418-01 .**

   ⚠ CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

   Remove the driver seat. For additional information, refer to Section 501-10 .

2. Remove the shield.



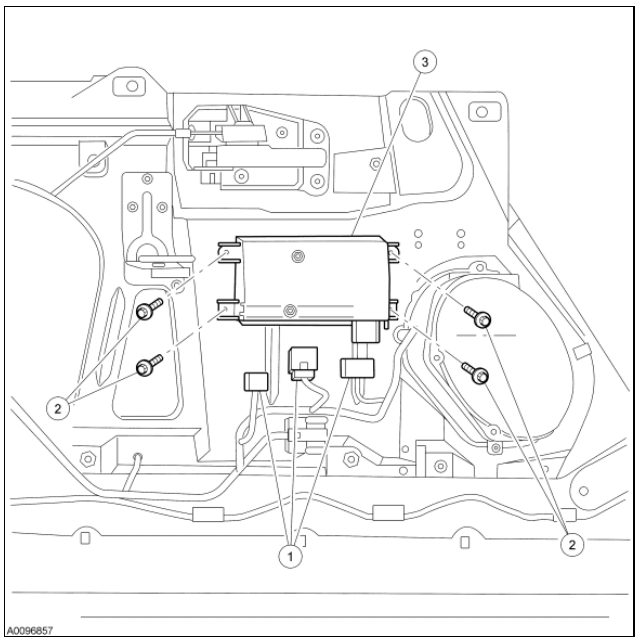
3. Disconnect the 3 DSM electrical connectors.

4. Slide the DSM out of the bracket and remove the DSM.

5. **NOTE:** Once the DSM is installed, it is necessary to download the module configuration information from the diagnostic tool into the new module. For additional information, refer to Section 418-01 .

   To install, reverse the removal procedure.

Driver Door Module (DDM)



Item	Part Number	Description
1	—	DDM electrical connectors
2	—	DDM bolts (4 required)
3	13C791	DDM

Removal and Installation

1. **⚠ CAUTION: Prior to the removal of the module, it is necessary to upload module configuration information to the appropriate diagnostic equipment. This information needs to be downloaded into the new module once installed. For additional information, refer to Section 418-01 .**

   ⚠ CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

   Remove the driver door trim panel. For additional information, refer to Section 501-05 .

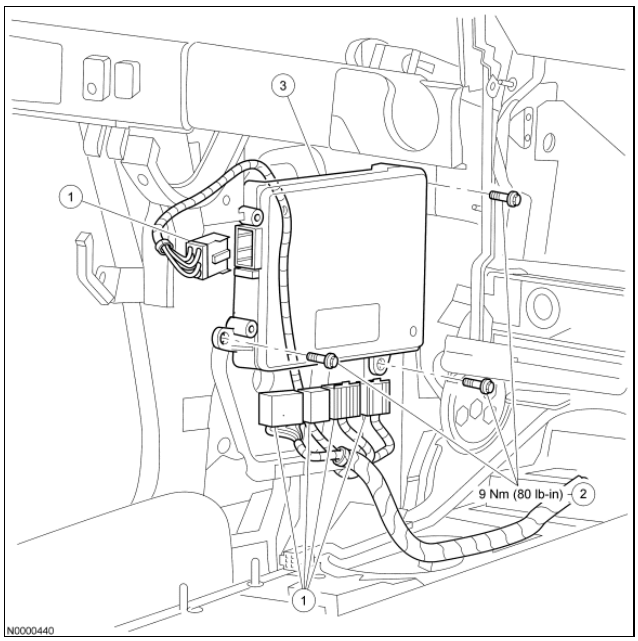
2. Disconnect the 3 DDM electrical connectors.

3. Remove the 4 bolts and the DDM.

4. **NOTE:** Once the DDM is installed, it is necessary to download the module configuration information from the diagnostic tool into the new module. For additional information, refer to Section 418-01 .

   To install, reverse the removal procedure.

Front Electronic Module (FEM)



Item	Part Number	Description
1	—	FEM electrical connectors
2	—	FEM bolts (3 required)
3	14B205	FEM

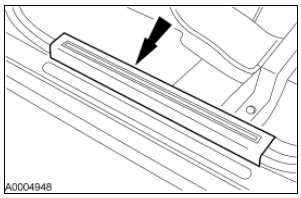
Removal and Installation

1. **⚠ CAUTION: Prior to the removal of the module, it is necessary to upload module configuration information to the appropriate diagnostic equipment. This information needs to be downloaded into the new module once installed. For additional information, refer to Section 418-01 .**

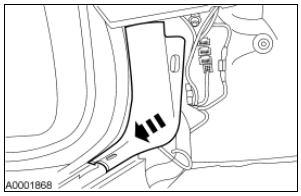
   ⚠ CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

   Disconnect the battery. For additional information, refer to Section 414-01 .

2. Remove the LH scuff plate.

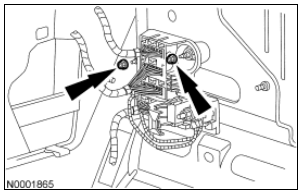


3. Remove the LH A-pillar lower trim panel.



4. Position the carpet aside.

5. Remove the 2 nuts and position the auxiliary junction box aside.



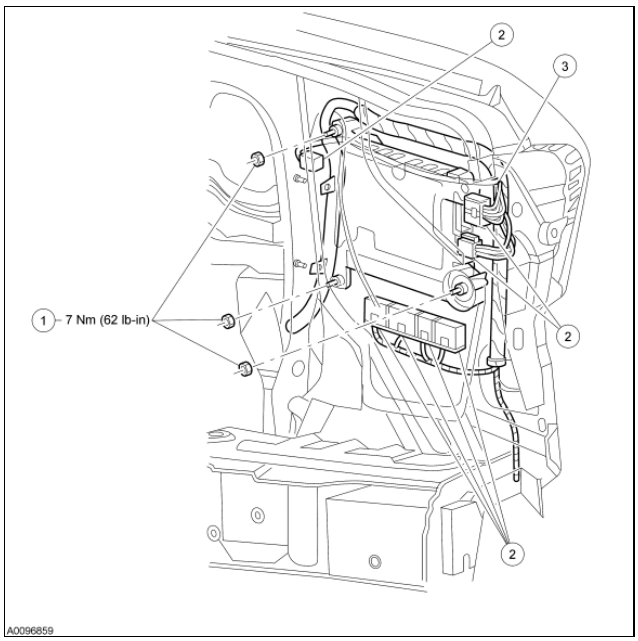
6. Disconnect the 5 FEM electrical connectors.

7. Remove the 3 FEM bolts and the FEM.
   - To install, tighten to 9 Nm (80 lb-in).

8. **NOTE:** Once the FEM is installed, it is necessary to download the module configuration information from the diagnostic tool into the new module. For additional information, refer to Section 418-01 .

   To install, reverse the removal procedure.

Rear Electronic Module (REM)



Item	Part Number	Description
1	—	REM nuts (3 required)
2	—	REM electrical connectors
3	13C788	REM

Removal and Installation

1. ⚠ **CAUTION: Prior to the removal of the module, it is necessary to upload module configuration information to the appropriate diagnostic equipment. This information needs to be downloaded into the new module once installed. For additional information, refer to Section 418-01 .**

   ⚠ **CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.**

   Disconnect the battery. For additional information, refer to Section 414-01 .

2. Position the RH rear luggage compartment trim panel aside.

3. Remove the 3 REM nuts.
   - To install, tighten to 7 Nm (62 lb-in).

4. **NOTE:** It may be necessary to position the REM rearward to access some of the connectors.

   Disconnect the 7 REM electrical connectors.

5. Remove the REM.

6. **NOTE:** Once the REM is installed, it is necessary to download the module configuration information from the diagnostic tool into the new module. For additional information, refer to Section 418-01 .

To install, reverse the removal procedure.

Electronic Compass

The compass display and module are an integral part of the interior rear view mirror. A 1 or 2 character display located in the upper right hand side of the mirror indicates the current direction of the vehicle (N, NE, E, SE, S, SW, W, NW). The compass continuously recalibrates due to changes in the magnetic field and remains accurate during most driving conditions.

Electronic Compass

Refer to Wiring Diagrams Cell 125 for schematic and connector information.

Special Tool(s)

ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

The compass is self-calibrating. This eliminates the need to manually set the compass. If the compass is displaying a heading and not displaying C or CAL, the compass is in auto-calibration mode. In this mode, the compass automatically calibrates for changes in vehicle magnetics over the life of the vehicle. This auto-calibration mode assures the compass heading is always accurate.

A display of C or CAL indicates the compass requires calibration. The compass may temporarily display C or CAL if the vehicle characteristics have changed (carwash, collision or other factors). Compass adjustment is controlled by the COMP switch which provides access to the calibration and zone adjustment procedures.

Excessive magnetism in or near the vehicle may cause the compass to display ALL SEGMENTS. In order to distinguish between vehicle magnetics and surrounding magnetics, drive the vehicle to an area that is free from large metal objects. Cycling the ignition switch ON and OFF resets the compass. A display of ALL SEGMENTS within 20 seconds indicates excessive vehicle magnetism and the vehicle should be demagnetized. Refer to Vehicle Demagnetizing in this section.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
Interior rear view mirror	• Central junction box (CJB) fuse 12 (5A) • Microphone • Circuitry • Compass sensor (integral to the interior rear view mirror)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, verify the symptom and GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Compass Is Inoperative

Normal Operation

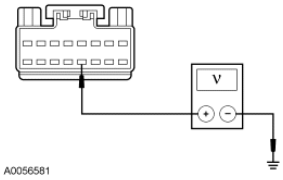
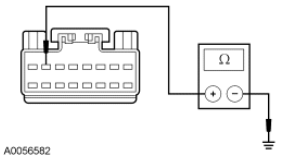
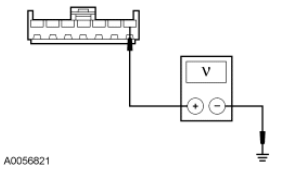
The compass display and module are integrated into the interior rear view mirror. The interior rear view mirror receives switched B+ voltage through circuit 75-AD15 (YE/BU). Circuit 31-AD15 (BK/OG) provides the mirror ground.

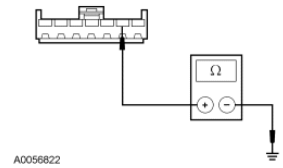
Possible Causes

- fuse
- circuit 31-AD15 (BK/OG) open
- circuit 75-AD15 (YE/BU) open or short to ground
- interior rear view mirror

PINPOINT TEST A: THE COMPASS IS INOPERATIVE

Test Step	Result / Action to Take
A1 CHECK THE VEHICLE OPTIONS	
• Check the vehicle options. • **Is the vehicle equipped with navigation?**	**Yes** GO to A2 . **No** GO to A4 .
A2 CHECK CIRCUIT 75-AD15 (YE/BU) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Interior Rear View Mirror C911. • Ignition ON. • Measure the voltage between the interior rear view mirror C911-13, circuit 75-AD15 (YE/BU), harness side and ground.	**Yes** GO to A3 . **No** VERIFY the central junction box (CJB) fuse 12 (5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

 A0056581 • **Is the voltage greater than 10 volts?**	
A3 CHECK CIRCUIT 31-AD15 (BK/OG) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the interior rear view mirror C911-2, circuit 31-AD15 (BK/OG), harness side and ground.  A0056582 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new interior rear view mirror. REFER to Section 501-09 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK CIRCUIT 75-AD15 (YE/BU) FOR VOLTAGE — AUTO-DIMMING INTERIOR REAR VIEW MIRROR	
• Ignition OFF. • Disconnect: Interior Rear View Mirror C9012. • Ignition ON. • Measure the voltage between the interior rear view mirror C9012-1, circuit 75-AD15 (YE/BU), harness side and ground.  A0056821 • **Is the voltage greater than 10 volts?**	**Yes** GO to A5 . **No** REPAIR the circuit. TEST the system for normal operation.
A5 CHECK CIRCUIT 31-AD15 (BK/OG) FOR AN OPEN — AUTO-DIMMING INTERIOR REAR VIEW MIRROR	
• Ignition OFF. • Measure the resistance between the interior rear view mirror C9012-2, circuit 31-AD15 (BK/OG), harness side and ground.	**Yes** INSTALL a new interior rear view mirror. REFER to Section 501-09 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

 • **Is the resistance less than 5 ohms?**	

Pinpoint Test B: The Compass Is Inaccurate

Normal Operation

The compass display and module are integrated into the interior rear view mirror. The compass adjustment and zone variation are controlled by the COMP switch on the mirror.

Possible Causes
- compass zone setting
- vehicle magnetization
- interior rear view mirror

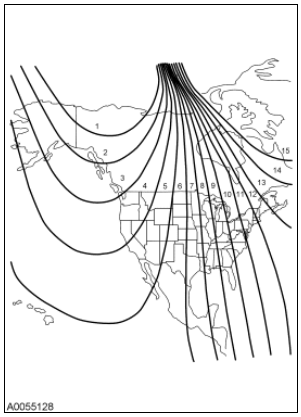
PINPOINT TEST B: THE COMPASS IS INACCURATE

Test Step	Result / Action to Take
B1 CHECK THE COMPASS ZONE ADJUSTMENT	
• Carry out the compass zone adjustment procedure. Refer to Compass Zone Adjustment in this section. • **Is the compass zone set correctly?**	**Yes** GO to B2 . **No** INSTALL a new interior rear view mirror. REFER to Section 501-09 . TEST the system for normal operation.
B2 CALIBRATE THE COMPASS	
• Carry out the compass calibration adjustment procedure. Refer to Compass Calibration in this section. • **Does the compass calibrate correctly?**	**Yes** GO to B4 . **No** GO to B3 .
B3 DEMAGNETIZE THE VEHICLE	
• Demagnetize the vehicle. REFER to Vehicle Demagnetizing in this section. • **Does the compass calibrate correctly?**	**Yes** GO to B4 . **No** INSTALL a new interior rear view mirror. REFER to Section 501-09 . TEST the system for normal operation.
B4 CHECK THE VEHICLE ACCURACY	

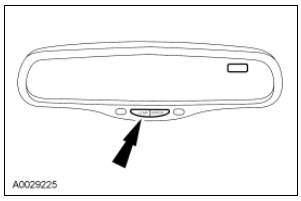
• Position the vehicle and observe the compass display as follows: **Direction** / **Compass Display** North — N Northeast — NE East — E Southeast — SE South — S Southwest — SW West — W Northwest — NW • **Does the compass calibrate correctly?**	**Yes** The compass is operating correctly. **No** INSTALL a new interior rear view mirror. REFER to Section 501-09 . TEST the system for normal operation.

Compass Zone Adjustment

1. Refer to the compass calibration zone map to select the correct compass zone setting for your geographical location.



2. With the compass display turned on, press and hold the COMP button (for 3 seconds) until the display shows the current zone of operation.



3. Release the button.

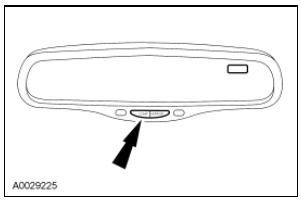
4. Press the COMP button repeatedly to cycle the zone number display. Set the zone display number to match the vehicle location on the compass calibration zone map.

5. Releasing the switch for 10 seconds exits the zone setting mode.

Compass Calibration

1. **NOTE:** For optimum calibration, drive to an open, level location away from large metallic objects or structures. Switch off all non-essential electrical accessories (rear window defrost, heater, A/C, map lamps and wipers) and make sure all doors are shut.

   Press and hold the COMP button until C or CAL is displayed (6 seconds). Release the COMP button.



2. Drive the vehicle at less than 8 km/h (5 mph) in a continuous circle until the compass heading is shown.

3. If the C or CAL message does not turn off within 5 circles, demagnetize the vehicle. For additional information, refer to Vehicle Demagnetizing in this section.

Vehicle Demagnetizing

⚠ CAUTION: During demagnetizing, the demagnetizer coil is pulled toward the vehicle. Place a cloth over the vehicle roof to protect the vehicle surface if contact occurs. Make sure the cloth covers the front third and the entire width of the roof.

NOTE: The demagnetizing process requires the use of a demagnetizing coil commonly used by television repair technicians to demagnetize television tubes.

NOTE: To demagnetize, use a constant circular motion over the vehicle roof. Do not turn off the demagnetizer while sweeping the vehicle roof to prevent remagnetizing ferrous materials contained in the vehicle.

NOTE: During the demagnetizing process, make sure the phenolic surface of the tool (the side opposite the handle) is closest to the vehicle surface.

NOTE: Turn the ignition switch to the OFF position.

1. Demagnetize the front third of the vehicle roof.
    1. Turn on the demagnetizer at least 1 meter (3 feet) away from the vehicle.
    2. Holding the demagnetizer no more than 2.5 cm (1 inch) from the roof, and starting on the passenger side, demagnetize the front third of the roof closest to the windshield using a constant circular motion. Keep the circle's radius within 30 cm (12 inches) while sweeping across the entire surface of the roof closest to the windshield. Continue the circular motion 4 times.
    3. After the fourth pass and without stopping, move the demagnetizer at least 1 meter (3 feet) away from the vehicle.
    4. Turn the demagnetizer off.

2. **NOTE:** The demagnetizer must be located over the exterior of the windshield no greater than 2.5 cm (1 inch).

   Demagnetize the interior rear view mirror mounting pad.

    1. Turn on the demagnetizer at least 1 meter (3 feet) away from the vehicle.
    2. Using a circular motion, pass the demagnetizer over the exterior of the windshield near the interior rear view mirror mounting pad. Without stopping, move the demagnetizer at least 1 meter (3 feet) away from the vehicle.
    3. Turn the demagnetizer off.

3. Carry out the compass zone adjustment procedure. For additional information, refer to Compass Zone Adjustment in this section.

4. Carry out the calibration adjustment procedure. For additional information, refer to Compass Calibration in this section.

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BODY.GRAY
{margin-top:1em;margin-right:1em;margin-left:1em;font-family:arial;background-color:E0E0E0;} B.BOLD
{font-weight:bold;font-size:10pt;font-family:arial;} B.UNDERLINE
{font-weight:normal;font-size:10pt;font-family:arial;text-decoration:underline} B.BOLDUNDERLINE
{font-weight:bold;font-size:10pt;font-family:arial;text-decoration:underline} CAPTION
{font-size:10pt;font-family:arial;font-weight:bold;text-align:left;} CENTER
{font-size:10pt;font-family:arial;} CENTER.SMALL {font-size:9pt;font-family:arial;} DIV
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